face of the mass; and that, by that means they must be equally electrified with the mass, that is, they must be covered with the electrical fluid to as great a distance from their superficies as the mass is covered; which must always be in proportion to the state of activity of the electrical fluid. In which state, when they have passed the surrounding fluid, they must be repelled by it; and also repel each other; and if each particle of vapour, and its surrounding fluid, occupy a greater space than the same weight of air, they must be fitted to ascend till they come in equilibrium with the upper and rarer part of the atmosphere; where they must float, till their specific gravity is altered. As it is very difficult to assign the magnitude of each particle of vapour and exhalation, and that of the surrounding fluid; and to show that both, taken together, occupy a greater portion of space than the same weight of air; we can only apply to experiment, to show that it is possible that it may be so; and that will show, that in all probability it is so; since it is evident, that every particle must be endued with a portion of this electrical fire or fluid; and that there is not any other sufficient cause assigned for their ascending.

It is evident, that on electrifying any light matter, such as down, or the downy parts of feathers, their specific gravity is much lessened; and that, by holding another electrified body under them, they may be driven upwards at pleasure. It is also evident, from experiment, that the more you divide the parts of such bodies, the more of their specific gravity they will lose by being electrified; and by dividing them into very minute parts, that they ascend to a considerable height after they are electrified. Hence he thinks it highly probable, that the exceedingly small particles of vapour and exhalation may be, and are, sufficiently electrified, to render them specifically lighter than the lower air; and that they do ascend by that means. And that they will ascend proportionally higher, as the surrounding fluid is proportionally greater than the particle which is carried up.

Mr. E. then endeavours to show that the ascent and descent of vapour and exhalation, attended by this fire, is the principal cause of all our winds. It being admitted that wind is only air put into motion, many have been the conjectures how that motion is caused. Among which, the motion of the earth, and the air's being rarefied by the sun, seem to stand first. The trade winds being most regular, and occupying a considerable part of the globe, it has been thought proper first to account for them, from the afore-mentioned causes. But he thinks that these causes, by themselves, are not sufficient for the motion of those winds, and much less so for the irregular motion of all the other winds. If the apparent motion of the air was occasioned by the diurnal revolution of the earth from west to east, by the air's being left behind, the motion must be found more regular, and very different from what it is; for in that case the

greatest motion must be at the equator, and from thence lessen gradually to the poles; and must be continued always equally one way, both day and night, and at all seasons. But we find quite the contrary: the most gentle gales blowing at the equator and between the tropics pretty steadily, one way all day long, and dying away at night; while high winds and storms, blowing all manner of ways, are found in the higher latitudes. Neither does he think that the sun's rarefying air can simply be the cause of all the regular and irregular motions found in the atmosphere; but he thinks the cause is the ascent and descent of vapour and exhalation, attended by the electrical fire, or fluid.

Now, all the vapour and exhalation, raised in the torrid zone, being buoyed up by the electrical fire, must add a column to the air, though of a different matter, at least 1000 times greater than the vapour and exhalation taken up; which column must necessarily force the adjacent part of the incumbent air upwards, and must as necessarily be reacted on by the incumbent air, to restore the equilibrium of the whole air. And as it cannot be readily forced down again, it must float off, at that altitude, toward those parts where little or no addition has been made to the atmosphere; and by that means must propel the air on the horizontal level with it, and that below it, as it is itself propelled by the weight of the incumbent air. And that motion must be from the equator, where the greatest quantity of vapour, &c. is raised, toward the poles, and partly to the west; as the column of vapour is always rising from east to west, as the earth turns toward the sun. For here we must confess, that the sun is the great agent in detaching vapour and exhalation from their masses; whether he acts immediately by himself, or by his rendering the electric fire more active in its vibrations; but their subsequent ascent Mr. E. attributes entirely to their being rendered specifically lighter than the lower air, by their conjunction with this electrical fire. The fire, which surrounds the vapour, beginning to condense, and the vapour to subside, in passing the tropics, becomes a greater pressure on the air beneath, and by that means forces some part back into the tropics, in the place of that air protruded by the ascent of the vapour, &c. and the remainder in a direction toward the poles. The common rotation of the air in coming in below, to supply the place of that part carried up by any fire, may explain this motion. To show how this motion must tend to the west, we must consider, that the column of air, raised by the ascending vapour, &c. is at its greatest altitude to the east, and therefore must press that air to the westward, which is continually protruded by the vapours, &c. beginning to ascend from east to west; and the compressed air at the tropics must tend to the westward, till their forces meeting make the motion entirely to the west. The air itself being rarefied, and carried up by the reflection of the intense heat of the sun, may be a considerable additional cause of these trade winds; but never can be the sole cause of all the

erratic winds. To account for all the irregular winds within the tropics, he says, that where such happen, it must be by means of some tracts of land, which rise to a greater height above the horizontal level, than vapours generally do; by which the motion of the vapours is stopped, and the vapour accumulated by succeeding vapour, and the air, on which they float, is of consequence pressed into a new direction. And from hence may also be explained the cause of the rains, particularly so called in the sea language.

He next considers what becomes of the vapour, &c. floating from over the tropics toward the poles; which being less affected by the heat of the sun, reflected from the surface of the globe, the surrounding electrical fire begins to condense more and more as it moves toward the poles, and the vapours of course to descend; and that part most, which is most remote from, or is farthest left behind by the sun; and of consequence the higher column of air must tend that way to restore the equilibrium; which motion, at this side the equator, must be to the north-east; and as the vapour, &c, fall again to the earth, the motion must be more to the east. Hence our south-west and westerly winds, which blow a considerable part of the year.

But as this system is too regular to account for the phenomena of the erratic winds, he considers whence they arise. He had before observed, that tracts of land rising into the atmosphere will stop the regular motion of the vapour, &c. and that the vapour being accumulated by succeeding vapour, the subjacent air must be pressed into new directions Now this cause, added to the daily dilatation of the electrical fire, and the contraction at night, and the coalition of the vapours, to occasion their total descent, will be sufficient to produce a very great variety of winds on this side the tropic.

It now remains to show, how the general phenomena of the weather and barometer arise from this system. First, Why it generally rains in winter, while the wind is south, south-west, and westerly. Secondly, Why north-west winds are generally attended by showers in the beginning, and become more dry, as they are of longer continuance. Thirdly, Why north and north-east winds are generally dry. Fourthly, Why the east wind continues dry and dark for a considerable time together. Fifthly, Why squalls precede heavy and distinct showers; and why a calm ensues for some little time after they are passed. Sixthly, Why storms and high winds seldom happen in a serene sky without clouds. Seventhly, Why the vapours, in warm seasons, coalesce to form those distinct dense clouds, which produce thunder and heavy showers. Eighthly, Why the barometer falls lowest in long continued rains, attended by winds; and why it rises highest in long continued fair weather; and why the intermediate changes happen. Ninthly, Of land-breezes and sea-breezes, and water-spouts.

First, the vapours passing the tropics into colder regions, have their sur-

rounding fire condensed by degrees; which must increase their specific gravity, and lessen their repulsive power: by which means they must both descend and approach each other, till at last they form dense visible clouds; and these clouds are also accumulated by other succeeding vapours, of like specific gravity, till they form clouds, which are often several hundred yards in depth, as is often seen, in passing through them up the sides of very high mountains. In clouds of such depth, he thinks the coalition of their particles to form drops, may arise from their motion, and the order of specific gravity. Hence he thinks the excess of electrical fluid will run off among the other particles; by which means the enlarged particles have their specific gravity increased, and are enabled to descend to a lower region of the air. And the more particles they impinge on, in their descent, the more their specific gravity and velocity will be increased; and the more their velocity is increased. the more particles will they impinge on, till they fall from the clouds in drops; whose size will be according to the depth and density of the cloud they have passed through.

Having remarked on several of the other particulars above enumerated, in a diffuse and uninteresting manner, Mr. E. then adverts to something of land-breezes and sea-breezes, a phenomenon which sometimes happens in fair settled weather, when the wind blows out from the land at night, and in from the sea at day-time. The land-breeze is occasioned by the descent of the clouds, and the particular formation of the land; for if the land rise into a hilly country from the sea, when the clouds and vapours ascend at night, which they often do by the electrical fluid being condensed, they must press the air down the land toward the sea in their fall; as may appear from the smoke of any fire running down the side of a hill, in the evening of a damp day, when the clouds are on the descent. And the sea-breeze is occasioned by the clouds ascending in the day-time, which must impel the incumbent air upwards, and make room for the sea-breeze to flow in; but, beside the mere ascent of clouds, there is an exceedingly greater quantity of vapour raised from the land than from the sea. For the same extent of land has an exceedingly greater surface than the same extent of sea; which may appear from the various forms of vegetables and animals, &c. and the greater the surface, the greater will be the evaporation. Beside, the more irregular these surfaces are, the greater will be the reflection and refraction of the sun's beams, which will increase their power. And it is also necessary that the evaporation should be much greater from vegetable and animal fluids, than from fluids in a quiescent state, to carry on a circulation for the great work of nutrition. Now the ascent of these vapours must beget a circulation of the air inward from the sea; in the same manner as the ascent of vapours from any fire brings in the air below to that fire.

As to water-spouts, he says they are oddly described by the learned, as being

great columns of water sucked up from the sea by the clouds. But he says he never saw any such; nor could he find, on inquiry from many honest men, who have sailed almost all the known seas, that they ever met any such; and therefore he does not believe that there are any such. There is indeed an appearance something like their description, which may have given rise to their conjectures; but this is no more than a very heavy shower from a very dense cloud, which is drawn into a conical form, and a very narrow compass at bottom, before it arrives at the sea, which it dashes with great violence in its fall.

Dr. Birch, the secretary, by order of the Society, having desired to know the experiments, by which Mr. E. found all ascending vapours and exhalations to be electrified; answers, at first he only supposed they must be so, according to the reasonings in his letter; but on trial, with a very simple apparatus, he convinced himself that they were so. He extended a fine string of silk, 8 feet horizontally, and from the middle suspended 2 pieces of such down as grows on the turf-bogs, by 2 pieces of fine silk, about 12 inches each in length; and then, by rubbing a piece of sealing-wax on his waistcoat, he electrified the pieces of down; and then brought sundry burning things under them, so as to let the smoke pass in great plenty through and about them, to try whether the electric fluid would run off with the smoke; but he observed that the down was but a little affected by the passage of the smoke, and still remained electrified. He then brought sundry steams from the spout of a boiling tea-kettle, and otherwise, in the same manner, and still found that the down remained electrified. He then breathed on them in great plenty, but found that the down still remained electrified. He then joined the palms of his hands together, with the fingers extended perpendicularly under the down, which still remained electrified; though the subtile effluvia, thrown off by perspiration, passed in great plenty through the down; as may appear by holding one or both the hands in the same manner under any light matter floating in the air, which will be driven upward, with as great velocity as an electrified feather is by any electrified body held under it.

The electricity remaining in the electrified down after these experiments, made it appear that the smoke and steams must be either electrics, or non-electrics electrified. It was easy to suppose them non-electrics, as they arise from non-electric bodies; and the more, because the highest electrics by a discontinuity and comminution of their parts, long before they come to be as minute as the particles of ascending vapour, become non-electrics, or conductors of electricity. For glass, resin, wax, &c. all become non-electric, even in fusion. But to try whether the steams, &c. were non-electrics, he only bedewed the wax and glass with his breath, steams, &c. from his hand to the end of the wax and glass; and then touching the electrified down with the end of the wax or glass, he found that the electrical fire immediately passed from the down into his hand, through

the steams, &c. which rested on the wax and glass. Which he thinks sufficiently proves the steams, &c. to be non-electric; and he thinks that it as plainly appears, that they are all electrified while ascending, because the electrical fire in the down does not join with them in their passage through it; which otherwise it would do with them, or any non-electric not electrified.

XXVI. Remarks on a Petrified Echinus of a singular kind. By Ja. Parsons, M. D., F. R. S. p. 155.

This echinus was found on Bunnan's-Land, in the parish of Bovingdon in Hertfordshire, which is a clay, and supposed to have been brought with the chalk, dug out of a pit in the field. The round echinites are for the most part found in chalk-pits, and they are in general, when recent, the most tender in their shells; so that the chalk is the most favourable bed for them to be preserved in long enough to be petrified; whereas in other kinds of matter, these would be mouldered and destroyed before the petrification could commence; and it is very singular, that almost all those in the chalk are filled with flint, or partly chalk and partly flint, and sometimes with crystal. Now, as all flints and agates are nothing else but crystal debased by earth, and as it is in beds of chalk that these as well as multitudes of large stones are found, one would be almost induced to believe, that chalk degenerated into flint; or, in other words, that flint was produced by chalk originally. And Dr. P. says he had many specimens, that seem to prove it; in some of which they seem to show the gradual change from the one to the other, not at all like a sudden apposition of chalk to flint.

Other kinds of echinites, such as the echini cordati, or heart-shaped echinite, the pileati or conic, the galeati or helmet-shaped, with several other kinds, are often formed of other species of stony particles. But the present fossil, being one of the oval kind, with large papillæ, is the echinometra digitata secunda rotunda vel cidaris mauri of Rumphius, which, with the other oval echinites, are very rarely found out of chalk; and it is remarkable, that whether they are filled with chalk, flint, or crystal, their shells break with a selenitical appearance, just as the lapides judaici, and all other species of echinites found in chalk-pits, do.

XXVII. On Toxicodendron. By the Abbé Mazeas, F.R.S. From the French. p. 157.*

The Abbé Sauvages, of the Royal Acad. of Montpellier, communicated a discovery of a plant, the juice of which adheres, without the least acrimony, to a cloth, with more force than any other known preparation. The colour is black,

* The vegetables mentioned in this paper, as well as in the following letter by Mr. Miller, belong to the Linnean genus *rhus*.

and the plant, which produces it, is the toxicodendron carolinianum foliis pinnatis, floribus minimis herbaceis. Abbé M. found also a plant of the same growing in a garden at St. Germain, then only about 2 feet high. This tree is remarkable for its leaves, which are continued like wings the whole length of the twigs. He pulled off one of the leaves, the juice of which produced a brownish colour on his ruffle, but did not change black in less than 2 or 3 hours.

He examined all the plants of the same class. Near this was the toxicodendron triphyllum folio sinuato pubescente, T. 611. Hederæ trifoliæ Canadensi affinis planta peregrina, arbor venenata quorundam, H. R. par. 84. Arbor trifolia venenata Virginiana folio hirsuto, Raii. hist. 1799. This plant was not yet above 3 feet high; its leaves are hairy; their pedicles, ribs, and fibres, are red; a leaf being pulled off, a milky juice issued from the pedicle, which being put on linen, became a finer black than the former, in less than half an hour.

In this botanical garden he saw another species of toxicodendron; this however was only a shrub, and appeared to be at its full growth. It is the toxicodendron triphyllum glabrum, T. 611. Hedera trifolia Canadensis Com. 96, vitis sylvestris trifolia. Park. Theat. 1556. This plant is remarkable for having an infinite number of black points scattered on the surface of its leaves, which seemed to be a juice extravasated through the punctures of insects. A leaf being pulled off, a milky juice flowed out, which, the instant it was exposed to the sun, became the finest and deepest black he had ever seen.

The Abbé thinks that if these two trees of Carolina were of their proper height, they would produce as fine a colour as this last shrub. He put the linen marked with the three black spots into a boil of soap, and it came out without the least diminution of the colour of the spots. When this linen was dried, he threw it into a strong lye of the ashes of green wood; and again it came out without the least alteration of the 3 shades of the spots, produced by the 3 plants. He took a handful of the leaves of the toxicodendron glabrum, to try if it might be of use in dying; and made a very strong decoction of it; and while boiling he dipped linen in it: it was tinged green, but, besides its not being a good green, the whole surface was unequally coloured; for several places took a fine black: whence he concluded, that the resinous juice of the internal parts of the plant was the only part capable of producing the desired effect. He was confirmed in this notion, after having let the decoction settle; it first let fall a black resinous juice in small quantity, like the opium of the shops: then a large quantity of a white sediment like a salt, which was quite tasteless on the tongue. The water appeared greenish above, and blackish towards the bottom of the vessel.

He would have tried some experiments on the roots of this plant; but, as there was only one in the garden, he was afraid of injuring it. Perhaps the

fruit or seeds might produce some kind of dye. Probably in making incisions in the bark, a juice might be obtained which might be turned to some use; for the blacks of our painted cloths, which are preparations of iron with nut-galls, after a certain number of washings, are quite spoiled, and only leave a rusty colour behind. But it is not so with the toxicodendron foliis pinnatis, since the Abbé Sauvages assures, that it was 5 years since his linen, marked with the juice of this plant, has retained the black spots, notwithstanding the great number of washings in lye it had gone through.

On the Same. By Mr. Philip Miller, F.R.S. p. 161.

That the above communication of the Abbé Mazeas might not appear in the Transactions of the R. S. as a new discovery, Mr. Miller gives the following brief account of what has been written on this subject.

Dr. Kæmpfer, in his Fasciculus Amænitatum exoticarum, has given a figure and description of this plant, which are so accurate, as to leave no doubt of its being the same plant as the Carolina toxicodendron. His book was printed at Lemgow, in 1712. His title of the plant is arbor vernicifera legitima, folio pinnato juglandis, fructu racemoso ciceris facie. And by the inhabitants of Japan it is called sitz vel sitz dsju, as also urus seu urus no ki. In the same book there is a figure and description of the wild varnish-tree, which he calls, arbor vernicifera spuria sylvestris angustifolia; and the inhabitants, fasi no ki; but the varnish which comes from this tree is of little esteem.

The seeds which were sent to the R. S. some years ago, for those of the true varnish-tree, by the Jesuits at China, prove to be of this wild sort; and the account which those fathers sent of the manner in which the varnish is procured, being so very different from that which is mentioned by Dr. Kæmpfer, that he here transcribes it, as follows. They first slit the bark of the branches of the shrub, in different places, with a knife: from these wounds there flows out a white clammy juice, which soon turns black when exposed to the air: the same juice is contained in the leaves and stalks of the plant. This juice has no other tasteable quality but that of heating without turning sour, but it is dangerous to handle, being of a poisonous nature. When they make these incisions in the branches of the trees, they place wooden vessels under them, to receive the juice as it drops from the wounds; and when these become dry, and will afford no more juice, they make fresh wounds in the stems of the shrubs, near their roots, so that all the juice is drawn out of them. They then cut down the shrubs to the ground, and from their roots new stems arise, which in 3 years is fit to tap again. This native varnish scarcely wants any preparation; but if any dirt should happen to mix with it, the Japonese strain it through a coarse gause, to cleanse it; then put it into wooden vessels, covering it with a little of

the oil called toi, and stretching a skin over it to prevent its evaporating. The varnish exhales a poisonous vapour, which occasions great pains in the head, and causes the lips of those who handle it to swell: on which account the artificers, when they use it, are obliged to tie a handkerchief over their nose and mouth, to prevent these effects.

The shrub is chiefly cultivated in the provinces of Tsi, Kocko, and Figo: and the best varnish in the world, he says, is produced about the city Jassino: but there are many other sorts of varnish, which are collected in Siam, Corsama, and other provinces, which are much inferior in their quality to this, and are produced by different plants: but one of the best among those, he says, is produced from the Anacardium, or Cashew-nut-tree. This is procured by perforating the bodies of the trees, and placing a hollow tube into the hole, under which is put a wooden vessel, to receive the liquor, as it flows through the tube; and when they have obtained as much of the juice as will flow out, they stop the holes made in the trees. This juice is white when it proceeds from the wounds, but changes black when exposed to the air. This varnish is used, without any mixture, for staining black; but the Chinese mix with it native cinnabar, or a red kind of earth, to make a different colour.

The plant, which the Abbé de Sauvages mentions, is also figured and described by Dr. Dillenius, in the Hortus Elthamensis, p. 390, by the title of Toxicodendron foliis alatis, fructu rhomboide, where he also quotes the description from Dr. Kæmpfer, with the account as above mentioned; and he has added all the synonyms from the different authors, who have mentioned the plant, and makes no doubt of its being the same with that of Japan, which, he says, should not seem strange, that a varnish-tree should be found in America, near the same latitude with Japan; since the Genseng, the Bignonia, commonly called Catalpa, with many other plants, are found to be natives of both these countries. And he questions, if the tea-tree might not be discovered in America, if persons of skill were there to search for it. And he is surprised, that the inhabitants of the English colonies in America have not attempted to procure the varnish, by which a considerable profit may arise to them, as the plant grows naturally in so great plenty there.

Mr. Catesby, in his Natural History of Carolina, vol. i. p. 40, has given a very good figure and description of this plant: he calls it toxicodendron foliis alatis, fructu purpureo pyriformi sparso. And he says the inhabitants of Carolina and the Bahama islands call it, poison-tree, and poison-ash, as the other 2 sorts of toxicodendron are called poison-oak in Virginia and New England. Mr. Catesby takes notice, that from the trunk of these trees is distilled a liquid, black as ink, which the inhabitants say is poison; but does not mention its being used there. There are two accounts of the poisonous quality of this tree, printed in

the Phil. Trans of the R. S. N° 367. The first was sent by the Hon. Paul Dudley, F.R.S. from New England, and the other was communicated by Dr. Wm. Sherrard, F.R.S. By both these accounts it is very plain, that this species of toxicodendron grows naturally in Virginia and New England, in as great plenty as Carolina, where all the species are the most common under-wood, in the lands which have not been cleared. He adds, that as these shrubs are so very common in our northern colonies, and the anacardium, or cashew nut-tree, is also common in our southern colonies of America; it were to be wished that the inhabitants of both would make some experiments to collect this varnish, which may not only produce much profit to themselves, but also become a national advantage.

XXVIII. On the Method of Constructing a Table for the Probabilities of Life at London. By the Rev. William Brakenridge, D.D., F.R.S. p. 167.

The great Dr. Halley, who had a singular faculty of applying his mathematical knowledge to the purposes of life, was the first who particularly attended to this subject. In the year 1692, from the bills of mortality at Breslau, he reduced it into a sort of science; and gave a table of the probabilities of life, that hitherto has been justly esteemed the most exact of any thing of the kind; from which he and others have deduced many propositions, that are highly useful. But a doubt having arisen, whether that could properly, or with any accuracy, be used by us at London, as we are in a different country, and perhaps in a different way of life, Dr. B. has been at some pains to inquire into this, and satisfy himself about the objections. And he imagines that he can now show how that table may be altered, to suit our case with sufficient exactness.

In the London bills of mortality, for the last 30 years, there is always added an account yearly of the number of burials under each age, at the distance of 10 years, and of children more particularly under 2 years, between 2 and 5, and between 5 and 10; which numbers are curious and useful. And though there may sometimes be some inaccuracies and omissions, these numbers are as exactly given as in our case can be expected: and what may be objected, is not so much to the incorrectness of them, as to what arises from our circumstances, that will not allow them to be proper to show the probabilities of life in all its periods.

But if we compare the numbers of the dead, in the several periods at Breslau, with those at London, we shall plainly see that the former show the decrements of life in a natural and regular way, and free from the difficulties and objections found in those of London. In the infant state, under 2 years of age, there is a 5th lost by death; but afterwards, as they gather strength, the deaths are diminished till between 10 and 20; and from that age the mortality gradually

increases, till after the age of 40; when the number of the dead continues nearly the same, though the probability of life continually decreases till the age of 80; and then at length, the living being almost all exhausted, the burials are greatly diminished. All which seems to be agreeable to the course of nature; but contrary to what we see in the London bills, especially after 50 years of age. However, they both agree in this, that the most healthy age is between 10 and 20, and the infant state under 5 years of age the most uncertain for life.

Indeed it must be acknowledged, that in computing the Breslau table, Dr. Halley had great advantages, which have made it so perfect. He had the number of births given, besides the burials at the different ages, in an inland town, where there is no great concourse of strangers. But with us at London, the number of births is not known; because of the number of Dissenters of various denominations, both foreigners and natives, of whose baptisms there is no account taken; which makes our bills at present very imperfect. For none are put into our bills but those who are baptized according to the form of our established church. And therefore there are some thousands omitted, and yet many, perhaps the one-half of them, who are not baptized with us, bury with us; which greatly perplexes our bills. And under this disadvantage it appears very difficult to make an accurate computation of the decrements of life through the different ages; though this defect he imagines he shall be able nearly to supply.

There have indeed been some ingenious men who have thought, that our London bills are correct enough to form a table from them, which may better agree with our circumstances than that which Dr. Halley has given us. And Mr. Smart was the first who endeavoured to do something in this way, from our bills only, about 18 years ago. But, in the table made by him, he seems to have been greatly mistaken; for he has made no allowance for the accession of strangers, but considered the numbers of the dead, in all the periods of life, as all come from those born here; whereas it is evident that the strangers, above 20 years of age, are at least equal to them. And this has brought this paradox into his table, that young people between 12 and 18, at London, are much more healthy than at Breslau, or in any country place in England. For according to him, in the 13th year, 2 die only out of 479; but at Breslau there die 6 out of 634; that is, there is double the number die more at Breslau than at London; which appears impossible. But between 30 and 40, he makes them much more unhealthy than they are; for at 40 he supposes one to die in 29; whereas there does not die above one in 30, all ages taken together, with infants included. Another ingenious gentleman, having seen this inconsistency, has endeavoured to correct it, by supposing that the number of strangers that come to settle in town, after 25 years of age, is inconsiderable; and that above that age, the numbers of burials may be considered, as arising from the natural de-

grees of mortality; and then by proportion, increasing the numbers of the living corresponding to all ages below 25; so that the table, altered in this manner, is the same with Mr. Smart's above that age. And it must be confessed, that this correction is very proper, and worthy of its author. But still the table is greatly defective, as he has made no allowances for the recess of great numbers who, after they have been a number of years in town, leave it, if they survive; and of many others who, after the age of 50, retire from business into the country. And which is so very obvious, that our burials are fewer than by proportion they ought to be after 50 years of age, as mentioned above, and by consequence the people appear more healthy after that age; so that after 70 they seem more healthy than at Breslau. For at 75 there appears from this table to die 4 out of 45, whereas at Breslau there die 10 out of 88.

And that a great number retire from the town, after the age of 50, or before, is further evident, if we suppose, even according to this corrected table, that one in 25 die at the age of 50. For then the number of people alive, between 40 and 50, will be greater than 2604 multiplied by 25, or 65100: which ought to be exhausted by all the deaths in the subsequent period. But all the deaths which ought to arise from that number of living, in the following years to 90, according to the bills in the 3d column, is 5315 multiplied by 10, or 53150; which is less than the people that were alive between 40 and 50, by 11950, or more. And therefore above 11000, of those between 40 and 50, must have retired from town.

But now, as our bills are defective, it is next to be considered, what we at London are to do at present, and what method of computation we are to follow? And Dr. B. imagines it is very obvious what may be done. Our bills may be used so far as 14 or 20 years; for there is certainly no increase of our people till the age of 14; because few young people come to town till they are fit to be apprentices or servants. And between 14 and 20, though many come at that time, yet there is an emigration of a great number from hence to sea, to other countries, the universities, and country academies, that nearly balances the accession of strangers. And then, after 20 years of age, the Breslau bills will be sufficiently correct, to show the probability of life within and about the city. And if so, a table may be made from both bills, that will agree with our case here with sufficient exactness. For he cannot find that there is any difference in the bills, above the age of 20, that can be depended on.

And from all considerations, he thinks it may be allowed, till it is otherwise demonstrated, by bills formed in a different manner from what they are at present, that the probabilities of life are much the same at London as at Breslau, at the age of 20 or after 14. And if we take this for granted, we shall from thence be able to form a useful table, for those within our bills, by accommodating and

joining the bills of both places together. And we may also nearly determine the number of infants born here, which hitherto has not been considered.

Now, from the births, which are found = 19561, and the numbers of the dead in the different periods known by our bills, it will be easy to form a table of the decrements of life; because the dead in the intermediate years may be found by proportion from the Breslau table. And accordingly Dr. B. computed the following, which is constructed from the London and Breslau bills together; which he thinks is a surer method of computing for us at London, than from either of them alone. The first part to the 21st year, is done from our bills, and the other part from the Breslau; but it is formed in such a manner, that it goes on as if from the bills of one place only. For, after the age of 20, it is continued by proportion, by making the dead at London in the decennial periods, to have the same ratio to each other, as the dead at Breslau. It supposes 1000 persons born in one year, and shows the annual decrease of them by death till 87 years of age, which may be considered as the utmost period of life. The intermediate numbers, marked d, show the dead in each year. The use of this table is well known to all who can compute the value of annuities for lives.

Age.	Pers.	Age.	Pers.	Age.	Pers.	Age.	Pers.	Age.	Pers.	Age.	Pers.	Age.	Pers.	Age.	Pers.
1	1000	12	403	23	361	34	311	45	248	56	176	67	99	78	28
	323 d		4 d		4 d		5 d		6 d		6 d		7 d		6 d
2	677	13	399	24	357	35	306	46	242	57	170	68	92	79	22
	127 d		4 d		4 d		6 d		6 d		6 d		6 d		5 d
3	550	14	395	25	353	36	300	47	236	58	164	69	86	80	17
	45 d		4 d		4 d		6 d		6 d		6 d		6 d		4 d
4	505	15	391	26	349	37	294	48	230	59	158	70	80	81	13
	32 d		4 d		4 d		5 d		7 d		6 d		7 d		4 d
5	473	16	387	27	345	38	289	49	223	60	142	71	73	82	9
	26 d		3 d		4 d		6 d		7 d		6 d		7 d		3 d
6	447	17	384	28	341	39	283	50	216	61	136	72	66	83	6
	13 d		4 d		5 d		5 d		7 d		6 d		7 d		2 d
7	434	18	380	29	336	40	278	51	209	62	130	73	59	84	4
	9 d		4 d		5 d		6 d		7 d		7 d		7 d		1 d
8	425	19	376	30	331	41	272	52	202	63	123	74	52	85	3
	7 d		3 d		5 d		6 d		7 d		6 d		6 d		1 d
9	419	20	373	31	326	42	266	53	195	64	117	75	46	86	2
	6 d		4 d		5 d		6 d		7 d		6 d		6 d		1 d
10	413	21	369	32	321	43	260	54	188	65	111	76	40	87	1
	6 d		4 d		5 d		6 d		6 d		6 d		6 d		
11	407	22	365	33	316	44	254	55	182	66	105	77	34		
	4 d		4 d		5 d		6 d		6 d		6 d		6 d		

XXIX. Of a Sheep, showed alive to the Royal Society, in November 1754, having a Monstrous Horn growing from his Throat; the stuffed Skin of which, with the Horn in situ, was placed in the Museum of the Society. By James Parsons, M.D., F.R.S. p. 183.

This animal was bred in Devonshire, with the preternatural horn appearing at

its birth. The novelty of the thing made the farmer spare the life of the lamb, and bring it up till it grew to the size of a well-grown sheep, pretty large of its kind, and about 3 or 4 years old. When it was brought before the Society, the owner said the horn weighed 26 lb.; and the creature swung it about, and raised it up with amazing strength. When he was fed, he moved forwards, letting the horn drag between his fore-legs, by which he was enabled to lay his nose to the ground; for the skin, by which it hung, was flexible, and though reduced to a neck, with respect to the circumference of the horn, yet it was hollow as well as flexible, leaving an open passage from the flesh of the neck to the cavity of the horn, and its contents. Sometimes the horn would come into such a position, as to twist the skin, which gave the sheep great uneasiness; but from experience he knew how to relieve himself, and from custom became ready at that, as well as bringing it between his legs to favour his feeding. It was in length along the convex or anterior surface, 2 feet 7 inches; and on the concave side 2 feet 1 inch; its greatest circumference 2 feet 2 inches, middle circumference 1 foot 6 inches; and near the apex 1 foot; and its weight is now 15 lb. though emptied of its contents.

It was said that on opening him there was found, in the top of the horn next the throat, which was hollow half-way down, a skull of a contracted round form, with blood-vessels running on it, and a bag filled with grumous blood, among which was a substance like a sheep's liver and lungs; and a perfect sound kidney, like that of a fresh loin of mutton. And this was attested by the names of 3 house-keepers of credit, who were present when the animal was opened, and who, if required, were ready to make oath of it.

XXX. A Dissertation on the Cancer of the Eye-lids, Nose, Great Angle of the Eye, and its neighbouring Parts, commonly called the Noli-me-tangere, deemed hitherto Incurable by both Ancients and Moderns, but now shown to be as curable as other Distempers. Addressed to the R. S. of London by Mons. Daviel, Surgeon and Oculist to the King of France, &c. Translated from the French by James Parsons, M.D., F.R.S. p. 186.

The examinations M. D. had made in these kinds of tumors had informed him, that cancers of the lids, nose, and adjacent parts, have all their seat in the periosteum, and perichondrium; and that a cure cannot be expected without taking them entirely off: for the vessels that go from the cancerous tumor are so strongly connected with the periosteum and perichondrium, that they seem but one body, which becomes at length so greatly swelled, that the very bone is often affected. When a wen or wart (which is often the beginning of a cancer) begins to appear, and it is attempted to be pulled off, it becomes irritated, and spreads so that the edges are reversed, and become callous and livid, accompanied

with a pain, and all other symptoms which characterize the cancer. These kinds of wens, warts, and tubercles, which are situated in the great angle of the eye, or on the lids, or the nose, often shoot out their roots on the cartilages, that is, on the very membranes which cover them, and the roots sink in sometimes to the substance of the cartilage itself, which they swell and tear in the end.

The more that cancers are touched with caustics, the more they are irritated; therefore there is but one method, but it is a sure one, of curing them, and hindering their progress; which is, to take them off with a cutting instrument, destroying the periosteum and perichondrium, or even the lids, if the cancer has penetrated them in their substance, with their cartilages: which the following observations will prove:

Observ. 1.—On a cancerous upper-lid. August 11, 1736, M. Daviel was called to Madame de la Fague, a nun, at Bourdeaux, 45 years old; for a tumor on the upper lid of the right eye, which she had for 20 years: it began by a small wen, and increased by degrees, so as very much to incommode her. She applied to a surgeon, who began by applying some drops of a liquid caustic, which enraged the tumor still more; which he appeased again by anodyne medicines; and then the tumor remained a long time without any sensible increase; though she felt a continual sharp pain in it. But, as even the least disorders are impatiently borne, she was willing to be relieved, and consulted another surgeon, who took off the tumor with a cutting instrument, and who, seeing that the ulcer, which was the result of the operation, did not heal, but on the contrary made great progress in its erosion, and became callous, he touched it with lapis infernalis; and sometimes with a liquid caustic: which so much the more increased the evil, and made her resolve to suffer no more applications, because all that had been tried made her worse and worse. She was now a long time in this state, when M. D. was called to consult with several other practitioners, who, having examined the case, agreed with him that there was no other method to be taken but the operation, not only to save the eye, but to prevent an incurable cancer, which threatened her life. Therefore he proposed the total extirpation of the lid: which proposal being approved of by all, as the only method of saving the eye, the operation was performed in the following manner:

He passed a crooked needle, with a waxed thread, under the lid, by which he suspended and drew up the lid and tumor, which he cut off with the crooked scissars, as much as he could under the orbit, separating the whole to the division of the lids; a small hæmorrhage ensued, but which was soon stopped with dry lint, and a dry compress and bandage.

She remained 24 hours without being dressed; was bled twice in the arm, after the operation: he then dressed her up with light dossils, armed with the

linimentum Arcæi, and she had not the least accident from the day of the operation to the 25th of the same month, when she was perfectly cured, without any deformity in her eye: and though the lid was cut away very high, the eye remained very neat and well, performing its several functions properly when he left Bourdeaux; and the 13th of August 1742, having had an opportunity of taking a journey to that town, he saw the patient again, whom he found extremely well, seeing perfectly with that eye: but what he found very singular was, that the skin of the lid descended pretty low, to the cornea, which it almost covered; so that the whole globe was in a manner hid. He only observed that this resembled a lid without hairs.

Observ. 2.—On another cancerous tumor in the great angle of the eye. July 2, 1736, Margaret Combaucaut, of Carcastone in Languedoc, 60 years old, had a cancerous tumour, for 16 years, in the great angle of the right eye: it began by a little wart, which itched violently, and made her scratch it very often, which so irritated the tumor, that in a little time it became as large as a dried fig flatted, with its edges turned outward and callous. It reached from the commissure of the lower lid, an inch and half below it, even to the right ala of the nose, which proved extremely troublesome to her. He found, after a strict examination, that it adhered to the bone. She said she tried all the remedies that she imagined would do her any good; but that, far from relieving her, they rather made her worse, and her disease became the more insupportable, and that she had taken a resolution to undergo any thing to be freed from a disorder which had afflicted her for 16 years.

Having consulted Mr. Fabre, an able physician of that place, they were both of opinion, that she could not be cured without an operation, which he accordingly proceeded to as follows: he took off the tumor entirely to the periosteum, but did not lay the bone bare; for he thought it sufficient for a complete cure to take away all the callosities; but he was mistaken; for instead of the prospect of a succeeding cure, he was unhappy enough to see the swelling increase, and the wound seem larger than before. He used in vain all the remedies commonly thought of in such cases; he scarified the edges of the ulcer, to bring it to suppuration; but it became more hard and callous than before the operation, and much more painful. He therefore resolved to cut away all that remained of the tumor, with the periosteum, which appeared very much swelled. This second operation had so much success, that the swelling, and every other bad symptom, disappeared almost suddenly; and in 3 days the wound looked red and very well, without any pain, and the cicatrix was perfectly formed on the 15th day from the operation, without any sensible exfoliation of the bone, or the least deformity or staring of the eye. She had remained very well ever after; for he saw her the 10th of August 1741, at Carcastone, in perfect health; and the cicatrix of the

part very even. He observes, that he laid the entire bone bare, wherever the tumour touched, even down to the ala of the nose of that side.

Observ. the 3d was on a cancerous tumor of the same nature, and in the same situation, and the treatment just the same; it was as large as a filbert, and the officer was afflicted with it 20 years. It differed from the former only in this, that the year before the officer came to Marseilles, to put himself under Mons. Daviel's cure, the tumor broke, and discharged a very fetid acrimonious matter, which, running into the eye, brought on a troublesome ophthalmia, and the edges were livid, and had a very terrible aspect. As to his operation, it consisted, as before, of a total extirpation of the cancer, periosteum and all, to the bare bone. He dressed the bone with dry lint only, and his digestive was a mixture of the linimentum Arcæi, with the unguentum styracis: and in about 19 days he was so perfectly cured, that when he returned to his friends, several of them asked him, on which eye the operation had been made?

Observ. 4, differed in nothing from the former.

Observ. 5, On a cancerous tumour on the nose, which reached from the root of the nose down to the middle of the cartilage. He treated it in the same manner, taking off the whole with the periosteum; and, as it was partly upon the cartilage, he also cut away the perichondrium, laying that, as well as the bone, bare: and the cure was completed, without leaving any deformity behind, in 18 days.

Observ. 6. Of a cancerous tumor on the great angle of the right eye of a woman at Marseilles, of 70 years old. This he treated exactly in the same manner, and she was cured in 20 days.

The 7th observation mentioned another cancerous tumor on the nose, and its cartilage, of a gentleman, which was circumstantially the same with the former: it was cured in 5 days. After this case he makes this conclusion: that from all that has been already said, it is plain, that the seat of the cancers of the eye lids, nose, and other neighbouring parts, is absolutely in the periosteum and perichondrium, as well as the fat; and that there can be no hopes of a cure without taking off these membranes, with the fat, and even any parts of the very cartilages that may be contaminated: but that in this manner they are as curable as cancers on other parts of the body, notwithstanding what all oculists have said to the contrary.

The 8th observation was on a cancer on the lower eye-lid of a woman, cured in the same manner.

The 9th observation treats on a cancer, as large as a large filbert, in the angle, and on the lower lid of the eye of a gentleman; which began by a small tubercle in the angle, and was pulled off, and grew again several times. Mons. Daviel was consulted, in the presence of another surgeon, Mons. Maillot, and

declared for taking the tumor and eye-lid entirely off; making this prognostic, that if any part was left behind, the eye would be deformed and staring; but the other surgeon thought, that half the lid with the tumor would be sufficient for the cure: Mons. Daviel therefore only cut away half the lid with the tumor; with which he also took off a large quantity of hard white fat, and dressed up the part as usual; but in the progress the lid was turned outward, and then they resolved on the total extirpation of the lid; which, being obliged to depart from thence, he left to Mons. Maillot, who performed it with such success, that his cure was complete in 15 days, without the least deformity whatever.

The 10th Observation is a case of the same nature with the former, with this difference, that when he had taken off the tumor and under lid in the same manner as usual; the patient continued getting well till the 9th day from the operation; when Mons. Daviel perceived a small fungus in the middle of the tumor, which he touched with the lapis infernalis, which produced very ill effects: the eye grew painful, the conjunctive swelled very much, the wound, which was half healed up, opened afresh, and became ragged. This made him set about cutting away all the bad flesh he could perceive, with the inequalities of the conjunctive, which was much swelled: he scarified the cornea, and in the inner surface of the upper lid, which was also greatly tumefied, and even opened it on the upper surface. Thus, after having emptied the vessels well, he fomented the whole with a decoction of marshmallows, mullein, violet-leaves, camomile-flowers, melilot, leaves and flowers of rosemary, thyme, lavender, rue, and marjoram, of each half a handful, in a sufficient quantity of water; to a quart of which he put a bit of camphor the size of a nut. The frequent application of this that day produced so good an effect, that all her pain ceased: he also bled her in the arm and foot, ordering emollient clysters. She was purged some days after, with manna and cassia, which did very well; and she was perfectly cured, without the least deformity, and could see better than before the operation.

XXXI. Of Four Roman Inscriptions, cut on Three Large Stones. By John Ward, LL.D., V.P.R.S. p. 196.

The stones were found in a field near a mile from Wroxeter, formerly a Roman station called Uriconium,* in the months of September and October 1752. The first of them was discovered by a plough striking against it; and by spitting the ground the other two were discovered, not far from the first, in the like situation. The first and last lay separate from their bases, which being taken up,

* In the year 1701, a Roman sudatory was discovered at this place, a draught of which, with some account of it, was published in the Phil. Trans. N° 306, which seems to have escaped the observation of Horsley, Brit. Rom. p. 419.—Orig.

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several broken pieces of urns, and dust of a greyish colour, were found with them, which seemed to have the appearance of ashes.

N° 1, is by the scale 6 feet 8 inches high, and about 2 feet 3 inches wide above the base. It has a pediment top, with a pine apple rising from the middle of the cornice, on each side of which is a lion, and in the area of the pediment a kind of rose. The inscription, which is cut in the plane of the stone, may be thus read; Caius Mannius, Caii filius, Pollia tribu, Secundus Pollentinus, miles legionis vicesimae, annorum LII, stipendiorum XXXI, beneficiarius legati principalis, hic situs est.

N° 2 contains two inscriptions, and is in height 2 feet 7¼ inches, by 2 feet 4¾ inches in breadth. It is not flat, as the former, but gently convex crosswise, the lower part being divided into 3 pannels; on the first two of which are the inscriptions, but the other seems never to have had any on it. The upper part is ornamented with a pediment, in the area of which are the remains of a face with curled locks, and 2 snakes under it; and on the cornice 2 figures like dolphins. The first inscription may be read thus: Diis Manibus. Placida annorum LV, curam agente conjuge annorum XXX. And the other in this manner: Diis Manibus. Deuccus annorum XV, curam agente patre.

N° 3 is 6 feet 11 inches high, and about 2 feet broad above the base. It has also a pediment at the top, the area of which is filled with a large flower. The inscription, it exhibits, may be read in the following manner; Marcus Petronius, Lucii filius, Menenia tribu, vixit annos XXXVIII, miles legionis XIIII geminæ, militavit annos XVIII, signifer fuit, hic sepultus est.

XXXII. On an American Wasp's Nest, shown to the Royal Society. By Mr. Israel Mauduit, F. R. S.* p. 205.

M. de Reaumur distinguishes wasps into three classes, from the different situations in which they place their nests; some choosing unfrequented parts of houses, some little cavities in the earth, and others the branches of trees for that purpose. The first of these is the largest sort, or hornet; the second is the common sort here in England; and the last is more frequent in America.

The nest, then shown to the Society, was sent from Maryland; where they are found on the lower kinds of trees, in the thickest parts of the woods. This was built on a dogwood-tree, or the cornus mas Virginiana; and hung quite detached from the rest of the tree by an extreme branch, of little more than an inch circumference: which, with its smaller divisions running through the substance of the nest, answered the purpose of pillars, to unite and support the several floors

* This wasp's nest, which is not described with sufficient accuracy, is probably that of the vespa nidulans of Fabricius.

of the fabric. The figure was a conoid, or an acuminated oval; its longer diameter 20 inches, the shorter near the base 12. It was perforated on 2 opposite sides, for the wasps to enter and go out at. The shell was composed of paper; the sheets of which at its upper end were larger and more distinct. They were of an ash-colour, of different shades, and streaked or marbled, and, being lightly laid on each other, formed a wall of from 1¼ to 4 inches thickness in the several parts of it. The lax hollow manner, in which they were joined to each other, rendered them a more effectual security from rain; as they attracted water in common with all other substances, made of the same materials; and would have been more easily soaked through, if they had been closer compressed together. For the same reason the apex of the cone was of the greatest thickness, and the base of a stiffer and more cellulose texture. This substance appeared to be a true paper; but, by the exact economy of nature, wrought to that degree of perfection only, which was necessary to serve the single purpose it was intended for. Being examined by the microscope, it appeared to be of a coarser grain, a shorter staple, and of a much looser texture; and was a rare, though not a singular instance, of a natural production falling far short of the artificial one of the same kind. The inside structure of these nests, is well described by M. de Reaumur.

XXXIII. Abstract of a Letter from the Magistrates of the City of Mascali, in Sicily, concerning a late Eruption of Mount Etna. From the Italian. p. 209.

On Sunday, March 9, 1755, about noon, mount Etna began to emit a great quantity of flame and smoke, with a most horrible noise. At 4 o'clock the air became totally dark, and covered with black clouds; and at 6 a shower of stones, each of which weighed about 3 oz. began to fall, not only all over the city of Mascali, and its territory, but all over the neighbourhood. This shower continued till a quarter after 7, that by the darkness of the air, the fall of stones, and the horrible eructations of the mountain, the day of judgment seemed to some to be at hand. After the stones had ceased falling, there succeeded a shower of black sand, which continued all the remainder of the night. The next morning, at 8 o'clock there sprung from the bottom of the mountain, as it were, a river of hot water, which in the space of half a quarter of an hour, not only overflowed to a considerable distance the rugged land, near the foot of the hill, but, on the waters suddenly going off, levelled all the roughness and inequalities of the surface, and made the whole a large plain of sand. The stones and sand, which remain where-ever the inundation of the water reached, differ in nothing from the stones and the sand of the sea, and have even the same saltness. After the water had ceased flowing, there sprung from the same opening a small stream of fire, which lasted for 24 hours. On Tuesday, about a mile below this opening, there arose another stream of fire, in breadth about

400 feet, like a river, which overflowed the adjoining fields, and actually continues with the same course, having extended itself about 2 miles, and seeming to threaten the neighbourhood.

XXXIV. Of the Charr Fish in North Wales. By the Rev. Mr. Farrington, of Dinas, near Caernarvon. p. 210.

This species they call torgoch, or red belly. This redness in the female, paler or deeper according to the season, resembles that of the fins of a roach, a fish very common in many rivers of England, though we have none of them in this country. The male is not adorned with that beautiful hue, yet he is finely shaded, and marbled on the back and sides with black streaks, on a kind of pellucid light sky-coloured ground. The shape is like a trout, but much more elegant and delicate. Three lakes or large pools, at the foot of Snowden, afford being and subsistence to this remarkable finny race. There is a communication between them. About a fortnight in December the charrs make their appearance; never wandering far from the verge of these lakes, or the mouths of the rivers issuing from them; but traverse from one end to the other, and from shore to shore indifferently, or perchance as the wind sits, in great bodies; so that it is a common thing to take in one net, 20 or 30 dozen in a night, at this place; though not above 10 or a dozen fish in all at any other. Thus in winter frosts and rigours, they sport and play near the margins of the flood, and probably deposit their spawn; but in the summer heats they keep to the deep and centre of the water, abounding in mud and large stones, as the shoaler parts do with gravel. After Christmas they are seen no more till the following year.

XXXV. A Method proposed to restore the Hearing, when injured by an Obstruction of the Tuba Eustachiana. By Mr. J. Wathen, Surgeon. p. 213.

Whatever obstructs that passage leading from the ear into the nose, called tuba eustachiana, so as to hinder the ingress of the air through it into the cavity of the tympanum, is universally deemed destructive to the sense of hearing. Hippocrates observed, that in a quinsy of the fauces, the patient became deaf, by its compressing and closing up this tube.* Many practical writers assert the same to have happened from adjacent ulcers, &c.;† and Mr. W. had known a swelled tonsil occasion deafness. This canal opens into the lateral and anterior

* Coac. 11. n. 35.

† Haller in Boerhav. de auditu, p. 380, and 416. Tulpius l. n. 35, a tumore palati. Valsalva, cap. v, p. 90, a polypo. et ulcere (viz. a certain yeoman had an ulcer above the uvula, on the left side, which communicated with, and corroded part of, the orifice of the left tuba eustachiana; which, when he stopped with a tent dipped in medicine, he immediately lost his bearing in that ear, but recovered it as soon as the tent was taken out).—Orig.

part of the cavity of the tympanum; is so shaped that it first decreases, as it descends towards the posterior parts of the nose, becoming very narrow; then suddenly diverging, is much enlarged, opening into the posterior part of the nose by an elliptic orifice, a little prominent, turning inwards and forward, placed laterally, and just above the velum pendulum palati. This canal then is composed of two distinct cones, the extremities of which unite together, but their bases diverge differently; it is likewise lined with a porous membrane, full of cryptæ and mucous cells, continued from and like to the membrane of the nares.*

When therefore we consider the structure of the eustachian tube, and its free communication with the atmosphere, we may reasonably suppose it subject to inflammation of its membrane, and concretion of its mucus, from cold, &c. like the external meatus; and though its mucus is of a very different nature, it is nevertheless liable to inspissate by heat, when its thinner parts are exhaled.† And from the form of this passage we may easily conceive, that an obstruction, pretty far advanced, is not to be removed without difficulty, and that in proportion, as it is more or less complete, the hearing will be more or less injured. Why then may not this be suspected as sometimes the cause of deafness? perhaps it is not unfrequently so; e. g. When a patient is somewhat deaf from cold, and the outer ear has been examined, and found clear of hardened wax, &c. it is yet not uncommon to find himself suddenly relieved by a great noise in his ear. This is probably owing to the breaking away of the congealed mucus, and the instantaneous rushing of the air into the tympanum; so that when this disorder is but slight and recent, nature seems frequently to relieve herself; but when more confirmed, her efforts are ineffectual for its removal. These considerations inclined him strongly to think the hearing might suffer from that cause, and he was much confirmed in it by the following very remarkable case.

Richard Evans, aged 35, was very deaf in both his ears, yet no visible disorder in the external meatus. It arose from cold, and had subsisted several years, during which time no art or means could procure him the least relief. In August, 1755, he died of the small-pox, at the hospital in Cold-bath-fields. Mr. W. took that opportunity to examine the eustachian tube of each ear, and found them both stuffed quite full of congealed mucus. This was the only visible cause of his deafness, the other parts appearing in their natural state. As

* Haller in Boerh. de Auditu, p. 378. Not. e Physiologia. Haller. de Auditu, § 485. Valsalva, cap. 2, p. 32. idem fig. xiv.—Orig.

† Morganni and others tell us, that they constantly find the cavity of the tympanum in infants always much clogged with mucus; and Mr. Douglas has often observed the same in adults, and is of opinion that it is concomitant with an obstructed tube in general, and that the injection is equally as effectual as if the tube only was obstructed.—Orig.

all these concurring circumstances strengthened him in his opinion, they likewise incited him to make trial of an operation that was some time before proposed to the Academy of Sciences, by Mons. Guyot; but the author having never practised it, he wanted the recommendation of facts to support and enforce it; it was therefore rejected by them as impracticable.*

Mr. W. first introduced his probe, a little bent at the end, through the nose into the tubes of several dead subjects; and, having thereby acquired a facility, he did the same on a person that was very deaf, and on whom all other means had proved ineffectual; no sooner had he withdrawn the probe, than he said, he could hear much better. This success excited his further endeavours, so that he had pipes of different sizes adapted to a syringe, and he had since injected the meatus internus in the following manner, with success. The pipe is made of silver, about the size and length of a common probe, and a little bent at the end: this being fixed to an ivory syringe, full of liquor (viz. a little mel rosarum in warm water), is introduced between the ala and septum of the nose, with its convexity towards the upper part of the aperture of the nares, and thus continued backwards, and a little downwards, till it comes near the elliptic orifice; then its convexity is turned toward the septum, by which the inflected extremity enters the tuba eustachiana with ease; the liquor is then impelled through it into the tube, by which the sordes, if any, being diluted, is washed out, and regurgitates through the nose, or mouth, or both, with the injection; and, if the quantity be large, may be seen.

[Then follows an account of 6 different cases, in which the operation was successfully performed.]

After the detail of these cases Mr. W. remarks, that he had endeavoured to ascertain the symptoms that indicate an obstructed tube, but had not been able to do it with any degree of certainty; nor could he see the great utility of it, could it be done; for the only disorders of the ear, that at present admit of surgical helps, are those of the external meatus, ulcerated and swelled tonsils, &c. all of which are generally visible; and when they are not the cause of deafness, little or nothing is ever attempted, the patient being left to shift for himself. But now another probable chance at least is given to the unhappy sufferer, and being the only one (e. g. the others either improper, or tried before without success),

* Hist. de l'Acad. 1724, p. 53. Besides, Mons. Guyot proposed doing it by the mouth, which is quite impossible, as evidently appears to any one that will give himself the trouble to examine into it. Convinced of this, Mons. Petit (who has lately published a new edition of Palfin's anatomy) proposed, and that learned and skilful anatomist Mr. John Douglas first demonstrated the possibility of, passing the probe, &c. through the nose into the eustachian tube; and this he has constantly shown to those who have attended his public lectures; and to him Mr. W. freely acknowledged himself indebted for the hint, by which he was incited to make trial on the living, of an operation of so much importance to mankind.—Orig.

may be made use of without delay, or attendance to accompanying symptoms, at least till they render themselves more conspicuous and certain than he had hitherto been able to find them; and as the operation is not at all dangerous, it neither has, nor will, he believed be thought painful by those who desire to recover their hearing.

XXXVI. A Chemical Essay on the Action of Quicklime on the Volatile Alkaline Salt. By I. A. Schlosser, M. D. of Utrecht. p. 222.

As the true nature of quicklime was unknown at the date (1755*) of this essay, the theory which Dr. S. has offered concerning the different phenomena produced by the action of burnt lime on the volatile alkali, is wholly erroneous. It is therefore deemed unnecessary to be more particular in the notice of this paper.

XXXVII. An Account of a very remarkable Case of a Boy, who, notwithstanding that a considerable Part of his Intestines was forced out by the Fall of a Cart upon him, and afterwards cut off, recovered, and continued well. By Mr. John Needham. p. 238.

On the 3d of January 1755, Mr. N. was called to the son of Lancelot Watts (a day-labourer, living at Brunsted) a servant boy to Mr. Pile, a farmer at Westwick, near North-Walsham, Norfolk, aged 13 years. He was overturned in a cart, and thrown flat on his face, with the round, or edge of one side of the cart, bottom upwards, whelmed across his loins, the upper part of the body lying beyond the wheel at right angles. In this helpless condition he continued some time, and was found with a very large portion of the intestines forced out at the anus, with part of the mesentery, and some loose pieces of fat, which Mr. N. took to be part of the omentum, hanging down below the hams, double, like the reins of a bridle, very much distended and inflamed. He had a continual nausea, and violent retchings to vomit, and threw up every thing he took. The pain of the stomach and bowels was exquisite, attended with convulsions; his pulse low and quick; and frequently he fell into cold sweats. After using an emollient and spirituous fomentation, Mr. N. reduced the parts, though to no purpose; the vomiting immediately returned, and forced them out again. Next day the fever increased, the nausea and retchings to vomit continued, the parts appeared livid and black, with all the signs of a mortification. On the 3d day the mortification increasing, he cut off the intestine, with the mesentery, close

* It was about a year after the above date that Dr. Black's experiments on quick-lime, which demonstrated so clearly the difference between mild and caustic calcareous earth, mild and caustic alkalis, &c. and which laid open so vast a field of discovery in gaseous chemistry, were first communicated to the world.

to the anus, being 57 inches in length. He had had no stool from the time of the accident, but soon after the operation there was a very large discharge of blackish and extremely offensive fæces, which continued several days, lessening by degrees. He soon became easy, and the nausea and vomiting abated. Mr. N. gave him tinct. cort. Peruv. simpl. twice a day; and, as he complained at times of griping pains, he took now and then tinct. rhabarb. vinos. and had recovered a good state of health. For some time he had 6 or 7, or more stools in a day; afterwards commonly 3 or 4, all loose, which come soon after eating; and frequently he was obliged to hurry out to ease himself, during his meals.

Mr. N. 3 times tried to discover a passage through the coats of the rectum, with his finger, and he thought he always felt an opening, just above the sphincter, towards the spine; the circumference of which was full, and protuberated, seemingly as large as his finger, the lower edge of which was harder than the rest; the patient complained of pain, when the upper part was pressed.

On the 7th of May the boy walked from Brunsted to North-Walsham, 7 miles, was perfectly well, and walked back again that afternoon.

XXXVIII. Experiments on the Sensibility and Irritability of the several Parts of Animals. By Richard Brocklesby, M. D., F. R. S. p. 240.

After apologizing for the cruelty exercised in these experiments, which Dr. B. made for the purpose of ascertaining the validity of Haller's doctrine, respecting the irritability of animal fibres, Dr. B. proceeds to state, that his first experiment was made by cutting 4 inches of a young lamb's skin, which covered the great tendon of the hinder leg, known to anatomists by the name of the tendo achillis. This of course caused violent struggles, and other marks of the injury felt; and on touching the extremity of the skin, while united to other parts of the animal, it cried loud, urined, and voided its excrement, when he poured diluted spirit of vitriol on the edges of the skin that were fixed to the contiguous parts; but did not express much pain by irritating the raised skin, at the farthest extremity of its separation, by an infusion of diluted spirit of vitriol. Nearer however to the fixed parts underneath, the sensation in the raised part of the skin continued much longer.

He then made the butcher cut into the tendon half way, and divide it upwards more than 2 inches, and attentively stood over the animal, to watch his motions, and discover if there was any apparent pain; but while that was doing, he could discern none, nor any marks of sensation in the animal, while he handled and pulled the cut tendon, nor yet any on touching it with dulcified spirit of nitre, and sharp acid spirit of vitriol; and what yet surprised him more, was to find the creature as insensible on the tendon, as if it was a mere piece of glue, when he put a strong muria of sea-salt and nitre all over it; and after a very few mi-

nutes he laid the raised part of the tendon in its natural direction, on the correspondent fixed part, and they were both exactly congruous; so that the loose part had not contracted itself, nor was at all shorter, after these repeated trials, than its correspondent fixed part. He then put the creature on its legs, to see whether it had suffered so much, that it could not use the leg; but it was found to walk, though favouring greatly that side where so much had been done; however, it walked fairly on all its legs. After about 5 minutes torment, the butcher ended all its pains, and he performed the same processes on a sheep just destined to be slaughtered, in which the Dr. found all the appearances as abovementioned.

He was induced to make 2 other very cruel experiments on different animals, by laying bare their patella's of the knees; having cut off all the skin round about, he then pricked and touched with the afore-mentioned escharotics the capsular ligaments of these joints, without discovering any tokens of pain; but as soon as the sharp fluids had spread over the surface, so as to reach the extremity of the skin, the creature underwent as much pain as cutting before had caused.

He desired the butcher to take off as much skin from the forehead, as was necessary to perform the operation of the trepan; and before he began to apply the instrument to the sheep's forehead, he vellicated the pericranium with the end of a knife, but could not observe the membrane sensible, or thrown into contractions; and when the operation was over, and the bone taken from the subjacent dura mater, he poured on this membrane dulcified spirit of nitre, and diluted spirit of vitriol, and powdered common salt, but without perceiving any agitations whatever, brought on by these substances acting on these living parts; though in some creatures he was dubious, whether sea-salt and nitre in powder did not create some sense, though no manifest contractions of the dura mater.

But every muscular part, which he cut while the animals were alive, discovered little sensibility of pain, though great propensity to irregular spasms of the fibres; and the muscles on the thorax, and especially the carneæ columnæ of the heart, retained irritability last of all other muscular parts, even till long after the animal's expiration.

He laid the pungent liquors and salts, as above, on various parts of the animal, yet alive; as on the fat, cellular membrane of the neck, leg, and other parts within the skin, the liver, pancreas and spleen, and could not find them endowed either with remarkable sensibility or irritability; nor had the bladder any remarkable symptoms of irritability, further than might be occasioned by its muscular fibres; though the well-known symptoms of the calculus show its great sensibility.

He tried the effects of a strong aqueous solution of opium on the irritated

parts of muscular fibres, but could not perceive an opiate manifestly to compose these spastic motions of the parts, as Haller alleges they do, though in some trials he fancied there were grounds for such a conclusion. However this is no argument against the internal use of opiates, where the solids are greatly irritated.

He adds one more experiment, made on the intestines of a lamb: after he had taken them from the carcase, he poured diluted spirit of vitriol on them, as well as several other pungent substances; and on the touch of all of them, the intestines renewed their contraction, which before had totally ceased, and surprised him with a motion almost as strong as is found in the process of chylification; and this continued till the external cold had indurated and stiffened the fatty membrane of the omentum.

These were some of many experiments of a like nature, which the importance of these facts in daily practice of medicine required to ascertain, or reject; and, from the result of his repeated trials, he was induced to coincide with most of the conclusions drawn by Drs. Haller, Castell, and Zimmerman; that no part is sensible but the nerves only, and that some parts are irritable without sensibility, accompanying them in any great degree; while others are altogether without sense, at the same time that they are incapable of being irritated at all.

Dr. B. adds, that he had thus communicated to the Royal Society the result of his experiments on this subject. Whether he should, by prosecuting the subject still farther, be able fairly to make out, that irritability, as it is distinguished from sensibility, depends on a series of nerves different from such as serve either for voluntary motion and sensation, he could not then say. But whatever might be his future conclusions, he would establish nothing hypothetical, but endeavour by fair deductions to approach towards truth, as near as the abstruse nature of the subject would permit; and as he thought he had actually found some variation from the common practice in rheumatisms, built on the established fact of great irritability in the muscular fibres, succeed, to the relief of suffering patients, he could not dismiss this subject, without relating, that only with gentle and continued frictions on the pained rheumatic parts with common sallad oil, 2 poor patients, who lately applied for his advice in obstinate rheumatisms, were, by thus relaxing the crispation of the solids, surprisingly relieved, without any further medicine. So that after bleeding, where it is indicated, which above all things he found to abate irritability, it might deserve to be tried, how far animal oils, applied by friction long continued to the aggrieved parts, both in the gout, rheumatism, and other painful diseases, would ease the tortures, without repelling or obstructing the matter, which nature is labouring to throw off. But he forbore to enlarge, as the experiments he had hitherto made on the subject of irritability, were scarcely sufficient to obtain what Lord Bacon calls the vindemiatio prima in this science. When he should receive suf-

ficient information to be convinced within himself, he should not be wanting to communicate what might tend to advance this branch of natural knowledge, and to promote a true theory of diseases, on which all rational practice must be established.

XXXIX. Of Worms in Animal Bodies. By Frank Nicholls, M. D. Med. Reg. and F. R. S. p. 246.

Fish are, to appearance, more subject to worms* than other animals; the cod often shows small slender worms, coiled up like snakes, on the surface of its liver; and the bley in the Thames, about the month of July, is often distressed by a long flat worm, which, by possessing and eating its liver, prevents the fish from compressing itself to that specific gravity, which is necessary for its quiet continuance under the water; so that it is obliged to skip about on the surface of the water, till it becomes a prey to its foes, or dies suffocated, by being so often out of water, and deprived of that action of the water which is analogous to the force of the air to us in breathing.

Among the many cases, which Dr. N. had seen, two seem to deserve particular attention, as well because they are greatly prejudicial to the farmer, as because, when generally known, they may possibly lead to a method of successful cure. The first of these is a species of dropsy, incident to bullocks and sheep. On opening these animals, when dead of this rot, the liver is always found affected. A small flat worm,† resembling a sole, and often many of them, is found in the gall-duct, by the butchers termed flooks [flukes]. It is the property of this worm, that it always builds a wall of stone for its defence; which wall is ramified like the gall-duct, within which it is formed. This stony tube, when completed, blocks up the gall-duct, and stops the passage of the gall; which thereby surcharging the duct, and dilating the orifice of the lymphatics, returns again into the blood, and gives the yellow teint to the eyes, which is the first symptom of this disease, and generally precedes the loss of flesh, and the swelling of the belly. It seems probable, that whatever can increase the acrimony of the bile, must be useful in preventing this disease; but when the stony pipe is formed, no method seems capable of promoting its discharge, or dissolution.

The other case is termed the husk, and is a disease to which bullocks are very subject, while young; for it rarely affects those of more than a year old. The creature is seized with a short dry cough, by which it is perpetually teized; in consequence of which he wastes in flesh, and grows weaker and weaker till he dies. On opening the lungs of a calf dead of this distemper, he found the wind-

* The worm here alluded to, is the *ligula abdominalis*. Linn. Gmel.

† This worm is the *fasciola hepatica*. Linn.

pipe, and its branches, loaded with small taper worms* of about 2 inches long, which were crawling about, though the animal had been dead many hours; and the farmer assured him that they always found these worms in this distemper, and knew of no method of cure. Dr. N. had great hopes however, that fumigations, either with mercurials, as cinnabar, or with fetids, as tobacco, properly used, might prove of great service.

XL. On some Remarkable Insects of the Polype Kind, found in the Water; near Brussels in Flanders. By T. Brady, M.D. p. 248.

The draught of the plant sent is found in summer-time, in all sorts of ditch or stagnant waters: its colour is white, and its transparent body, when seen with the naked eye, is in length between one and a half and two lines; but when viewed with a good microscope, whose focus is about 8 lines, it appears as in pl. 15, fig. 1, with leaves,† branches, and fruit, and indued with such sensibility that at the least noise made in the room, or on any thing touching the table where the microscope stands, or the water in which it lies, it contracts itself with such activity and swiftness that the eye cannot follow it in that motion, till it reduces itself into the shape in fig. 2. The extension or dilation goes slower, and requires about half a minute before it comes to the form in fig. 5. It can live in its own standing-water for 8 or 10 days, and then looks as in fig. 6, as most trees do in winter-time. It is remarkable that the leaves, which are like bells, live some time after they fall, and retain that faculty of contraction and dilatation; and when viewed with the great magnifier, whose focus is about 2 lines, it appears as in fig. 4. The trunk is as in fig. 3. The number of its branches are undetermined, but commonly found to be between 6 and 12. He had not tried if it did not regenerate, when cut like polypes: but he could see a vast difference between it and the polype a bouquet, mentioned by Trembley.‡ The other curious insect, represented in fig. 7, is found in the same standing-waters with the plant, and is seen with the naked eye, like a little flat round leaf, whose diameter is about one line and a half; but when put in a microscope, it shows a circle surrounded with crowned heads, tied by small thin tails to a common centre, whence they advance towards the circumference, where they turn like a wheel, with a great deal of vivacity and swiftness, till they cause a kind of a vortex, in which are seen all smaller insects or bodies either attracted or driven, which probably serve as nourishment for those little crowned things, which in all appearance are, as well as the plant, a sort of insects of prey, that live on smaller creatures. When one of those little heads

* These worms belong probably to the species of ascaris called ascaris vituli. Linn. Gmel.

† Vorticella anastatica. Linn.

‡ Vorticella socialis. Linn. Gmel.

has wheeled a while, it rests, and another turns out; and sometimes 3 or 4 are seen wheeling at a time. He had seen last year some much more regular, that formed an orderly circle, with their crowns to the circumference, and their thin bodies like so many radii joined to the centre. Their motion is all straight towards the edge of the circle, and never to the right and left, as if every head had its proper limits to act on.

The fruit of the plant, which resembles an orange, has a kind of chain about it, that turns as the crown does in the other insect. The trunk or stock of the plant is its gut, or stomach; for he saw, that something descended through it, as it were through a gut. Besides it has no support of any fixed point, but is always swimming in the ditch-water, but shows no great local motion. Other insects were seen preying on it, which resemble small hogs, and are very busy in eating its leaves, which are probably the cause of its looking so bleak and withered when dead.

XLI. New Astronomical and Physical Observations made in Asia; and communicated by Mr. Porter, Ambassador at Constantinople, and F.R.S. p. 251.

Observed Latitudes of the following places.

Aleppo. Lat. North........	36^h	12′	Antioch..............	36^h	10′	
Mount Cassius............	36	4	Diarbekir	37	54	
Seleucia in Syria	36	3	Bagdad..............	33	19	54″

Immersion of ω Virginis under the Moon, observed June 10, 1753, at Diarbekir, near the Seraglio of the Bachaw.

The Immersion of the Star at night..........	9^h	48^m	4^s
The Emersion	9	39	47

The nitre is produced by a combination of the universal acid with the natrum of the ancients, as appears by observations. The asafœtida is drawn from a ferulaceous plant of the thapsia kind, which is very common in Media, &c. I have had the good luck to find the small nardus Indica: It is a gramineous plant, of which some bear spicaceous flowers, both male and female, and others only female ones. It is a valuable thing to botanists, as they are hitherto ignorant of the true genus of this plant, though the root has been in use ever since the age of Dioscorides. This country is so dry, that electrical experiments often succeed without any stand of bitumen, pitch, silk, glass, &c. Our carpets and beavers are mostly sufficient to retain the electrical virtue, and prevent its spreading to the floor. Ten men standing upright, one before the other, have been made electrical, and, being touched, have produced sparks.

XLII. Some Observations, proving that the Fetus is in Part Nourished by the Liquor Amnii. By Malcolm Fleming, of Brigg, M.D. p. 254.

July 25, 1753, being informed that a calf, come to full maturity, was just then brought forth dead in this town (Brigg, in Lincolnshire,) which had been alive, and appeared strong a very short time before its birth; Dr. F. begged it of the owner, such instances being rare. The skin being of value, for it was an extraordinary large calf, it was sent to his house flayed. He first examined the thorax, which was his chief motive for begging it. He here adverts to the experiment of the lungs of a new-born animal sinking in water. After cutting out the lungs and heart, he clipped off a piece of the former with sharp scissars, about an oz. weight, or more, and threw it into a basin full of water. It quickly sunk to the bottom, and settled there. Immediately after, he blew into the remaining part of the lungs, through the trachea; and though he could by that means distend them but very little, because the air flowed out readily through the cut bronchia, and therefore acted but faintly on the other parts; yet a piece about the same size as the first, clipped off in the same manner, and thrown into the same basin, constantly kept at the top. This might seem foreign to his present purpose; but he thought proper briefly to mention it here, not only on the account of the importance of the experiment, but likewise to show, that he was not misinformed in the account of the calf's being brought forth dead, and that it had not even respired; much less taken any nourishment after exclusion, to influence the appearances described below.

Having opened the abdomen, he observed the thick intestines, especially the rectum, extremely distended with an incredible quantity of meconium; which for several inches above the anus was formed into distinct scybala or balls. He made an incision in the rectum, where it was very turgid, about 2 inches from the anus, and let out about 25 or 30 of these scybala; which he laid on clean paper to dry, that he might examine them at his leisure. About 3 or 4 days after, when they were dry and brittle, and of the colour and consistence of aloes, he was surprised to find, on examination, every ball stuck full of tough, thick, white hairs, some of which were an inch long, or more. There seemed to be some scores in each, though, being shrunk with drying, they scarcely exceeded the bulk of an ordinary pea. This unexpected appearance set him on considering, whence these hairs had come; how got they there? and he could think on no other tolerable solution of the difficulty than to conclude that they belonged originally to the calf's skin; and, being loosened by maceration in the liquor amnii, were propelled into the stomach and intestines; till they were at length entangled in the meconium. He was confirmed in the belief of this by being informed, on inquiry, that the calf's skin was white; a circumstance unknown

to him before, it having been sent flayed. From this persuasion it was natural to infer that if hairs loosened from the skin of the fetus, and floating in the liquor amnii, can find a way into the intestines, and get entangled in the meconium, it is impossible but the liquor amnii must enter and pass through the whole alimentary passage along with them; as a fluid may certainly penetrate where hairs cannot: but no good reason can be assigned, or even conceived, why hairs should be admitted where the fluid is excluded.

The only reasonable scruple that remained to be got over was, that this being but a single instance, a general conclusion was not to be too hastily drawn from it; that it was possible there might be some morbid concretions in the meconium of this particular calf, resembling hairs, which concretions in a common and natural way might be wanting; or some preternatural communication between the primæ viæ in this subject, and the liquor amnii, not to be found in the generality of other fetuses. But he afterwards received some of the first dung of other calves, in which he also found a great number of strong hairs all over; so as to leave no room for doubting but that this appearance is general in the meconium of calves, in a natural way.

The reader will please to observe that in neither of these instances he could be deceived, if he had ever so little reason to trust to the judgment and fidelity of those who supplied him with what he wanted. The colour and consistence of the meconium of a fetus is so very peculiar, and so widely different from that of fæces formed out of ingested aliments, that none, who have any knowledge in these matters, can mistake the one for the other. In the mean time he omitted not to open the embryos of the cow-kind, such as he could procure in the shambles of the market-town he lived in, and to examine their meconium. The 2 most advanced towards maturity, which he met with, had stiff long hairs about the mouth, the eye-brows, the ears, and navel, and a good many on the end of the tail; but none on their skins. In neither of these, any more than in the younger embryos which he examined, was there so much as a single hair to be found in the meconium; for this plain reason, if he judged right, because they had not got hairs on their bodies of long enough continuance to become loose, and float in the liquor amnii.

But as opportunities of coming at fetuses of this species, especially such as are remarkably nearer to maturity than those 2 just now mentioned, are rare, he tried to supply that defect by opening those of other animals. Accordingly he procured 6 puppies, of the butcher-dog kind, brought forth at the full time at one litter. Having taken out the whole meconium of every one of them, after the strictest search he could find no hairs in any part of it. He had likewise an opportunity of opening a colt that died either in the birth, at the full time, or immediately after, before its meconium was discharged; which he found in great

quantities in its rectum and colon. But neither here could he spy a single hair, though he examined whole pounds of it, and that portion most carefully which was lodged in the rectum, near the anus.

These observations might seem at first view to clash with and contradict those he had related: but, on closer consideration, they would be found in reality to confirm them, for this reason, that puppies and colts, when brought forth, have no loose hairs on their bodies; but calves have in great numbers. In the puppies and colt, which he examined, the hairs were so firmly rooted on their skins, that he could scarcely pull any off with his thumb and fingers; whereas in a mature calf, new brought forth, many are found quite loosened at their roots, and only adhering to their skin by the moisture on it. Therefore in the latter species hairs from the surface may be, and actually are, incorporated with the liquor amnii, and along with it enter the mouth and alimentary canal, which cannot be the case in the former. From these facts Dr. F. infers that the liquor amnii is in a constant natural way received into the mouth, stomach, and intestines, and therefore must contribute to the nutrition of the fetus.

XLIII. On the Success of Agaric in Amputations, &c. By Mr. William Thornhill, late Surgeon to the Infirmary at Bristol. p. 264.

Mr. T. here states that he had employed the agaric successfully in 4 cases of amputation.

XLIV. A Lunar Eclipse observed at Elbing, March 27 *and* 28, 1755. *By John Mendes Sachetto Barbósa, F. R. S., and Prof. of Philos. and Physic.* p. 265.

27^d	10^h	51^m	15^s	the beginning was certain.
28	1	27	40	the end of the real eclipse.
	1	31	30	the penumbra certainly ended.

XLV. On the Number of People in England. By the Rev. Wm. Brakenridge, D. D., Rector of St. Michael Bassishaw, London, and F.R.S. p. 268.

There seems to be only two ways of discovering the number of people in England, where at present there are no capitation taxes; either by the number of houses, or the quantity of bread consumed. As to the first, it is evident that if the number of houses could be determined, it would then be very easy to compute nearly the number of people. For it might be easily known by trial what number, at an average, could be allowed to each house, and from thence the whole number of people deduced. In a former letter Dr. B. assigned 6 to a house in town, which he found to be the nearest number, in some parishes, by an account taken; but he thinks it is still more plain in the country that 6 is

the number to be fixed on, where people do not go so much into single life, and where there are not so many lodgers. For if we consider that for every marriage there are four births, on an average, as Dr. Derham, Major Graunt, and others have shown, and which Dr. B. found to be true from the registers both in the town and country; consequently, allowing for deaths, there cannot be 3 children that survive from every marriage to mature age, and indeed not much above 2, as appears from Dr. Halley's table of the probability of life. Therefore every family, where there are children, one with another, cannot consist of more than between 4 and 5 persons, besides servants or inmates: which shows plainly that families, where there are children, cannot be estimated at more than 6 to a house, and where there are no children they cannot be reckoned more at an average.

The number then being 6 to be assumed, let us next consider what number of houses is to be supposed. That Dr. B. might come at some certainty in this, he applied to one of the public offices, where he thought they could very likely give an account of them; and he there found, that before the year 1710, and near about that time, an account had been taken of all the houses throughout England and Wales, in order for some assessment upon them; and the number then amounted to 729048. In which it may be supposed that a number of cottages were omitted that might be improper for that assessment; but he thinks there could not possibly be above a 4th part of that number more: for surely the surveyors, if they had any care of the public revenue, would never omit above one in 5. Let us therefore suppose, that there might be a 4th part of that number more; and then those omitted will be about 182262, and the whole number of houses could not exceed 911310.

If now we take 911310 for the number, it is evident, if we allow 6 persons to a house at an average, the number of persons in England and Wales, before the year 1710, could not be above 5467860. And since that time, 45 years ago, by a method of computing which he shows below, the increase could not be above 789558; and so the whole number of people now must be about 6257418; or six millions, all ages included; for it must be remembered that in our wars, since 1710, there could not be fewer lost than 200000, which is to be deducted from that number.

As to the other way of determining this, by considering the quantity of bread consumed, it may perhaps at first view appear more uncertain; but it will, he thinks, from some things that may be observed, at least help to ascertain the above number. For it is plain, if the quantity of wheat that is produced in England could be known, it would then be very easy to make the computation, as it might be nearly discovered, by a little observation, what each person at an average might consume. But the great difficulty is to find out nearly the quan-

tity of wheat; and there seems to be no way at present of knowing it, but by considering what proportion it may have to the barley; for the quantity of that is nearly known from the malt-tax. Now, if we compare the quantity of the wheat in England, it is evident, that there is at least as much ground sowed with the one as with the other. For there are vast tracts of land that will not bear good wheat, but are frequently sowed with barley; and even those lands that will produce good wheat, they are often alternately sowed with it: the land that is rich and well manured, after one crop of wheat it is usual to sow it with barley. And if this be admitted that the quantity of land sowed with the one is equal to that sowed with the other, there must then be a much greater quantity of barley; because the same number of acres will produce much more of it, and generally in a greater proportion than 3 to 2.

If then we assume that the barley used in malt is to the wheat used in food at home, as 3 to 2, we shall then be able to compute the quantity of each of them in this manner: the malt-tax from the year 1747 to the year 1753 inclusive, amounted to the sum of 4,254,813 l. of which the 7th part, the tax for one year, is 607830 l. and as the tax is 4 shillings on every quarter of barley, it follows that there are 3039150 quarters of barley consumed yearly in malt; and therefore there must be 2026100 quarters of wheat consumed at home. Now, as it is known, that labouring healthy people at an average consume about one quarter of wheat in the year, which is about 512 lb. of flour, or 1 lb. 6 oz. in a day, we may allow that healthy and unhealthy, grown people and children, do not consume the half of that quantity, one with another. And therefore, that we may make the consumption of each person at an average as small as can reasonably be imagined, we will suppose that 3 people, children included, do not consume more than one hearty labouring person, that is one quarter in the year, or each person about 7 oz. in a day; and by this supposition the above number of quarters of wheat 2026100, consumed at home, will be sufficient for 6078300, or six millions of people. And this quantity of a quarter to 3 persons, though it appears too little, may be admitted, as in some of the northern countries they use some oat-bread and rye-bread; and every healthy person may, one with another, be allowed to consume this quantity at least. From this calculation it seems that there cannot be above 6 millions of people in England. And as, from the other method of computing from houses, we found the number to be about 6,257400, from which at least 200,000 is to be taken for those lost in the wars since 1710, or near that time; it appears that both these calculations confirm each other, and that the number of people may be considered at about 6 millions, or rather less. In which, according to Dr. Halley's rule, there will be about 15 hundred thousand men able to carry arms.

Dr. Derham, from the computations of Mr. King, supposes there is about 5½

millions of people in England; to which, if we add the increase that may be since that time, the number will be near about what we have made them. But Sir William Petty has endeavoured to make them, in his time, no less than 7369000, by supposing them to be in proportion to the assessment, then 11 times greater than that in the city of London. In which, with regard to the city, he was certainly mistaken, as Dr. B. showed last year; for the number at that time, in 1682, was not much above 504000, and therefose 11 times that, viz. 5544000 must, according to his own hypothesis, be the number of people in England. And if we allow 1355000 to be the increase in about 73 years since that time, the number could not be now, according to that assessment, above 6899000. From which we ought at least to subtract 400000, which may be justly allowed for loss in our wars since 1690; and the remainder 6499000 is not half a million more than we have made them. The people then being computed at 6 millions, or rather less, it appears that England is but thinly peopled. For not only the exportation of at least 400,000 quarters of wheat *annually* shows plainly that we want people to consume it at home, and that we maintain in bread about a million of foreigners abroad: but if we examine more particularly, we shall find that the country is capable of supporting one-half more inhabitants, or 9 millions.

But in Ireland the case is still worse: for if there is but a million of people, as is commonly supposed, and according to Mr. Templeman 27400 square miles, which is 17,536,000 acres, and a 4th or more be supposed waste; then there will be at least 12,000,000 good acres. And consequently if 4 acres in that country be allowed sufficient, at an average, for the maintenance of one person, Ireland, if duly cultivated, could maintain 2 millions more people than it has now, or 3 times its present number of inhabitants. And in Scotland, if there be, as is said, but a million and a half of people, for at present I know no way to compute them, and 27700 square miles, or 17,728,000 acres, and $\frac{1}{3}$ be supposed waste, which is not too much in that country, then there will be 11,000,000 good acres; of which, if we suppose that 5 acres of that soil is not more than sufficient for each person, then there may be provision for 2,200,0000 people, or more, with the advantages of fishing, that is 700000 more than there are at present. From all which it is plain, that if the land in both the British isles was duly cultivated, they might sustain about 6 millions more people than they do now; that is as many more people as England now contains. And here, by the way, it may be observed, if we extend our thoughts to the whole globe of the earth, and compare the quantity of land with the number of people, we shall find that it will maintain above 26 times the present number of mankind.

The proportion being given of the living to the dead in one year, and also the proportion of the births to the dead, the number of the people being unknown;

to find in what time the people shall be in any given proportion, to what they are at present. Suppose n to be the unknown number of the people at present, and let the living be to the dead, in one year, as l to 1, and the dead to the births as 1 to b, the proportion given to what their number is at present as p to 1, and the number of years required to be y. It is plain then, that the dead at the end of the first year will be $\frac{n}{l}$, and the births $\frac{bn}{l}$, and the whole number of people must be $n + \frac{bn}{l} - \frac{n}{l}$. In like manner, at the end of the 2d year, the dead will be $\frac{ln + bn - n}{l^2}$, and the births $\frac{lbn + bbn - nb}{l^2}$, and the whole number of people must be $n + \frac{bn}{l} - \frac{n}{l} + \frac{lbn + bbn - nb}{l^2} + \frac{n - ln - bn}{l^2} = (\frac{l + b - 1}{l})^2 n$. And so at the end of the 3d year the number of people will be $(\frac{l + b - 1}{l})^3 n$. From which at length it is evident by induction, that the number of people at the end of the required number of years will be $(\frac{l + b - 1}{l}) n$. But as the proportion is then to be as p to 1, we shall have $(\frac{l + b - 1}{l})^y n = pn$, and thence $(l + b - 1)^y = pl^y$. And because the logarithms of equal quantities must be equal, we shall have $y \times \log. (l + b - 1) = \log. p + y \times \log. l$, and also $y = \frac{\log. p}{\log. (l + b - 1) - \log. l}$. And therefore the number of years y is determined by the logarithms of known quantities, when the people shall be in the given proportion of p to 1.

It may be observed that the quantity $(\frac{l + b - 1}{l})^y n$ may be considered as the ordinate of the logarithmic curve, whose abscisse is the index y, and that the ordinate passing through the beginning of the abscisse, where $y = 0$, must be equal to n.

If now it be required to know when the people shall be doubled; let us substitute in the above formula, instead of b, l, p, the respective numbers 1.12, 40, 2. and it will be $y = \frac{\log. 2}{\log. (40 + 1.12 - 1) - \log. 40}$; and then the logarithms being taken we shall have $y = \frac{0,3010300}{0,0013009} = 231$; which shows that, according to the present state of births and burials, the people could not be doubled in less than 231 years. And by the same method it appears, changing the signs of $b - 1$, that 230 years ago, in the time of Henry the 8th, the number could not be above $\frac{1}{2}$ of what it is now, that is about 3 millions.

And so if we were to find, when the number of people in England would be increased to 9 millions, which, by what has been said above, is near about the outmost that can be maintained, from the natural produce of the country; we should then have $p = \frac{3}{2} = 1.5$, because 9 millions is to the present number as 3 to 2, and also $y = \frac{\log. 1.5}{\log. (40 + 1.12 - 1) - \log. 40} = \frac{0,1760913}{0,0013009} = 135$; which

shows that, at the present rate of births and burials, it must be 185 years before England can be fully peopled.

If we suppose, as Sir William Petty does, that the burials are to the births as 9 to 10, that is 1 to 1.111, which is something less than that of Dr. Derham's proportion, and that 1 dies in 40 in a year; if we substitute these numbers in the formula, we shall then find the time of doubling to be 250 years. For then it will be $y = \frac{\log. 2}{\log. (40 + 1.111 - 1) - \log. 40} = \frac{0,3010300}{0,0012035} = 250$; which shows how far Sir William was mistaken in his method of calculation, when he made the time to be 360 years.

After the same manner, the number of years being given, it will be easy to find the proportional increase. Suppose after 45 years. For then we should have $45 \times \log. (l + b - 1) - 45 \times \log. l = \log. p$; which will give $45 \times 0.0013009 = \log. p$, and therefore $p = 1.1443$, from which if n be equal to 5,467,860, we have $pn = 6,256,872$. So that it appears if there was 5,467,860 people in England at the year 1710, when the above-mentioned survey was made, there is now 6,250,000; if none were to be deducted on account of our wars, and emigrations to our colonies since that time.

From what has been found above, that $(l + b - 1)^y = pl^y$, it is evident, that the ratio of the increase in any number of years may be determined, without the number of people being known, or their proportion to the annual increase; and also that any one of the quantities l, b, y, p, may be found, the others being known. But if the ratio of the number of people to the annual increase be known; and consequently the proportion, of the number in any one year, to the number next year known, we shall then have a very simple equation. For if we suppose the number of people in any one year, to be to that number with the increase added in the next year, as 1 to r, we shall then have $nr^y = np$, or $r^y = p$. And, in like manner, if the proportion of the number of people to their increase, in a given cycle of years, had only been known, and that cycle be c, we should then have $nr^{\frac{y}{c}} = np$, or $r^{\frac{y}{c}} = p$. From which formula it would be easy to calculate the numbers of mankind, in all ages through the world, if we suppose them to arise from a given number, and the rate of increase known, in any period of years. And this may sometimes be of use to discover the number in any age, that might be possible to reason on, and to find out the truth of any hypothesis.

XLVI. An Attempt to Explain Two Roman Inscriptions, cut on two Altars, which were dug up some time since at Bath. By John Ward, LL.D. and V.P.R.S. p. 285.

These two inscriptions were found near the same time and place, with that

which has been already published in the 48th vol. of the Philos. Trans. The altars, which contain them, are in the possession of Dr. William Oliver, physician at Bath, who has placed them in his garden, and who transmitted draughts of them, with their inscriptions, taken by the Rev. Mr. Borlase, F.R.S. And after that, Mr. Prince Hoare sent casts of the inscriptions in plaster of Paris.

The inscription on the higher altar may, Dr. W. thinks, be thus read in words at length:

Peregrinus Secundi filius, civis Trever, Jovi Cetio, Marti, et Nemetona, votum solvit libens merito.

The person, who dedicated this altar, calls himself PEREGRINVS SECVNDI FILIVS; each of which names occurs several times in Gruter, as a cognomen, which often stands alone, when the person named is sufficiently distinguished by it. Having given us his own name, and that of his father, he proceeds to acquaint us with his country, and stiles himself CIVIS TREVER, a people who inhabited that part of Belgic Gaul between the Maese and the Rhine, which is now the electorate of Triers; and were conquered by Cæsar, with the rest of the Gallic nations. Their chief city, which was situated on the Moselle, being made a Roman colony in the reign of Augustus, is by Tacitus called Colonia Treverorum, but by others more frequently Augusta Treverorum, and now Triers.

The 3 following lines of the inscription contain the names of 3 deities, to whom this altar was dedicated. The first of these is here called IVPITER CETIVS. Ptolemy makes mention of a large mountain in Germany, which he calls Κέτιος, and describes as the eastern boundary of Noricum, by which it was separated from Pannonia, now Hungary. From this mountain it seems highly probable, that the name Cetius might be given to Jupiter, as its tutelar deity.

The 3d and last name here mentioned, is NEMETONA, which Dr. W. had no where else met with; but as it stands connected with the two former by the particle ET, it must, he thinks, denote some deity, and by the termination a goddess. The last line of the inscription acquaints us with the cause of erecting this altar, which was the performance of some vow, formerly made by Peregrinus. And it is not improbable, that he had laboured under some bodily disorder, which occasioned his going to Bath for the benefit of the waters, which in the time of the Romans were in so high esteem. And the good success which he met with by the use of them, may be concluded from the tenor of the inscription, wherein he makes his acknowledgement to the deities above-mentioned, for the benefit he had received through their favour, in consequence of his addresses to them for that purpose. For as it was a common notion of the ancient pagans, that all human affairs were under the direction of their deities; so in any danger or misfortune they used to solicit them for relief, with vows and pro-

mises of erecting altars and other buildings to their honour, in case of a favourable answer. Which, when performed, they were said votum solvere, as the letters v. s. here imply.

The other inscription, on the lower altar, when expressed in words at length, may be read in the following manner:

Sulevis Sulinus Scultor, Bruceti filius, sacrum fecit libens merito.

That the first word SVLEVIS denotes a name given to certain rural goddesses, called Sulevæ, is plain from an inscription found on a stone at Rome, and published by Fabretti, in which they are joined with Campestris. The 2 next words, SVLINVS SCVLTOR, must, he thinks, stand for the names of the person who dedicated this altar; as the 2 following, BRVCETI F. acquaint us with that of his father. The words SACRVM FECIT, in the last line, are of the same import with dedicavit; in which sense likewise sacrum alone is often used. And sometimes the reason of the dedication is added, as, sacrum, voto suscepto, fecit, in Gruter. But that not being mentioned here, must remain unknown.

There is nothing said in either of these inscriptions, which can afford any light towards settling the time, when they were erected. But so far as appears from the form of the letters, they may not improbably be supposed of somewhat a later date, than that mentioned before, as found near the same place.

XLVII. Of a remarkable Echinus. By Gust. Brander, Esq. F.R.S. p. 295.

This echinus was of a very singular species. It appeared to be of a middle nature between the echinus and the star-fish. It came from the island of Bourbon in the East Indies, and he could not learn that it was any where described. See fig. 10, pl. xi.

XLVIII. Of an Impression on a Stone dug up in the Island of Antigua, and the Quantity of Rain fallen there for 4 Years. By the Rev. Francis Byam. p. 295.

This stone was brought from a quarry for a building in the town of Antigua: the quarry is in the side of a mountain, and is about 300 yards higher than high-water mark, and about 2 miles from the sea. When the mason struck it with his hammer it split in two, and discovered the exact figure of a fish, on each stone, called an old wife.

The quantity of rain that fell in Antigua, was in 1751, 51.8 inches; in 1752, 43.3 inches; in 1753, 32.8 inches; in 1754, 75.2 inches.

XLIX. On the Stones mentioned in the Preceding Article. By Mr. Arthur Pond, F.R.S. p. 297.

The impression of this fish is in a chalky kind of stone, of a pale ochrey co-

lour; some parts, when scraped, are white, and all the impression is of a yellowish brown, nearly the colour of brown ochre. The impressions of the bones and fins are very perfect; and the cavity, that contained the back-bone, extremely sharp and delicate. When Mr. P. first saw it, 2 or 3 of the vertebræ were in it. All the cavities of the bones are now sufficiently open to contain them, and it is probable that most, if not all of them, were in the stone, when it was first split. Between the rib-bones and the two long fins, which come down from the head, which parts were only fleshy, there is no impression, the stone having united quite through; and on the upper part of the fin, by the side of the cheek, is a deep impression of a very small cockle-shell. The impression on the counter-part of the stone is much the same, except that the tail is wanting.

L. On the Effects of Lightning in the Danish Church, in Wellclose-square. By Gustavus Brander, Esq., F. R. S. p. 298.

On Monday, Nov. 17, between 6 and 7 o'clock, there was, among many others, one most amazing flash, accompanied with a clap of thunder, that equalled in report the largest cannon. The next morning, the minister observing the church clock to be silent, they went into the belfry, and found the wire and chain, that communicated from the clock in the belfry, to the clapper in the turret, where the bells hang, were melted; and that the small bar of iron from the clock, that gives motion to the chain and wire, just where the chain was fastened, was melted half through, the bar being about $\frac{3}{4}$ of an inch broad, and half an inch thick. By several links of the chain, and of the wire, it is observed, that the lightning took effect only in the joints. But whether it entered by communication, from the wire exposed to the air in the small turret, through the roof of the belfry, or at the windows, there being several panes broken in the south and west corners, is uncertain; though Mr. B. presumes rather the first way, as it is very possible, that the bare report of the thunder might have occasioned the latter.

The pieces of the wire and chain were scattered over the whole belfry, nor could it be discerned, that the wood-work, or ought else, had suffered.

LI. Electrical Experiments, made in Pursuance of those by Mr. Canton, dated Dec. 3, 1753; with Explanations. By Mr. Benjamin Franklin, F. R. S. Dated Philadelphia, March 14, 1755. p. 300.

Principles.—1. Electric atmospheres, that flow round non-electric bodies, being brought near each other, do not readily mix and unite into one atmosphere,

but remain separate, and repel each other. This is plainly seen in suspended cork balls, and other bodies electrified.

2. An electric atmosphere not only repels another electric atmosphere, but will also repel the electric matter contained in the substance of a body approaching it; and, without joining or mixing with it, force it to other parts of the body, that contained it. This is shown by some of the following experiments.

3. Bodies electrified negatively, or deprived of their natural quantity of electricity, repel each other, (or at least appear to do so, by a mutual receding) as well as those electrified positively, or which have electric atmospheres. This is shown by applying the negatively charged wire of a phial to two cork balls, suspended by silk threads, and by many other experiments.

Preparation.—Fix a tassel of 15 or 20 threads, 3 inches long, at one end of a tin prime conductor; (mine is about 5 feet long, and 4 inches diameter) supported by silk lines. Let the threads be a little damp, but not wet.

Exper. 1.—Pass an excited glass tube near the other end of the prime conductor, so as to give it some sparks, and the threads will diverge.—Because each thread, as well as the prime conductor, has acquired an elastic atmosphere, which repels, and is repelled by, the atmospheres of the other threads: if those several atmospheres would readily mix, the threads might unite, and hang in the middle of one atmosphere, common to them all.

Rub the tube afresh, and approach the prime conductor with it, crossways, near that end, but nigh enough to give sparks; and the threads will diverge a little more. Because the atmosphere of the prime conductor is pressed by the atmosphere of the excited tube, and driven towards the end where the threads are, by which each thread acquires more atmosphere.

Withdraw the tube, and they will close as much.—They close as much, and no more, because the atmosphere of the glass tube, not having mixed with the atmosphere of the prime conductor, is withdrawn entire, having made no addition to, or diminution from, it.

Bring the excited tube under the tuft of threads, and they will close a little. —They close, because the atmosphere of the glass tube repels their atmospheres, and drives part of them back on the prime conductor.

Withdraw it, and they will diverge as much.—For the portion of atmosphere, which they had lost, returns to them again.

Exper. 2.—Excite the glass tube, and approach the prime conductor with it, holding it across, near the opposite end, to that on which the threads hang, at the distance of 5 or 6 inches. Keep it there a few seconds, and the threads of the tassels will diverge. Withdraw it, and they will close.—They diverge, because they have received electric atmospheres from the electric matter before

contained in the substance of the prime conductor; but which is now repelled and driven away, by the atmosphere of the glass tube, from the parts of the prime conductor, opposite and nearest to that atmosphere, and forced out upon the surface of the prime conductor at its other end, and on the threads hanging to it. Were it any part of the atmosphere of the glass tube, that flowed over and along the prime conductor to the threads, and gave them atmospheres (as in the case when a spark is given to the prime conductor, from the glass tube), such part of the tube's atmosphere would have remained, and the threads continue to diverge; but they close on withdrawing the tube, because the tube takes with it all its own atmosphere, and the electric matter, which had been driven out of the substance of the prime conductor, and formed atmospheres round the threads, is thereby permitted to return to its place.

Take a spark from the prime conductor, near the threads, when they are diverged as before, and they will close.—For by so doing you take away their atmospheres, composed of the electric matter driven out of the substance of the prime conductor, as aforesaid, by the repellency of the atmosphere of the glass tube. By taking this spark, you rob the prime conductor of part of its natural quantity of the electric matter; which part so taken is not supplied by the glass tube; for when that is afterwards withdrawn, it takes with it its whole atmosphere, and leaves the prime conductor electrized negatively, as appears by the next operation.

Then withdraw the tube, and they will open again.—For now the electric matter in the prime conductor, returning to its equilibrium, or equal diffusion, in all parts of its substance, and the prime conductor having lost some of its natural quantity, the threads connected with it lose part of theirs, and so are electrized negatively, and therefore repel each other, by Pr. 3.

Approach the prime conductor with the tube near the same place as at first, and they will close again.—Because the part of their natural quantity of electric fluid, which they had lost, is now restored to them again, by the repulsion of the glass tube forcing that fluid to them from other parts of the prime conductor: so they are now again in their natural state.

Withdraw it, and they will open again.—For what had been restored to them is now taken from them again, flowing back into the prime conductor, and leaving them once more electrized negatively.

Bring the excited tube under the threads, and they will diverge more.—Because more of their natural quantity is driven from them into the prime conductor, and so their negative electricity increased.

Exper. 3.—The prime conductor not being electrified, bring the excited tube under the tassel, and the threads will diverge.—Part of their natural quantity is

thus driven out of them into the prime conductor, and they become negatively electrized, and therefore repel each other.

Keeping the tube in the same place with one hand, attempt to touch the threads with the finger of the other hand, and they will recede from the finger.—Because the finger being plunged into the atmosphere of the glass tube, as well as the threads, part of its natural quantity is driven back through the hand and body, by that atmosphere, and the finger becomes, as well as the threads, negatively electrized, and so repels, and is repelled by them. To confirm this, hold a slender light lock of cotton, 2 or 3 inches long, near a prime conductor, that is electrified by a glass globe, or tube. You will see the cotton stretch itself out towards the prime conductor. Attempt to touch it with the finger of the other hand, and it will be repelled by the finger. Approach it with a positively charged wire of a bottle, and it will fly to the wire. Bring near it a negatively charged wire of a bottle, it will recede from that wire in the same manner, that it did from the finger; which demonstrates the finger to be negatively electrized, as well as the lock of cotton so situated.

LII. Extract of a Letter concerning Electricity, from Mr. B. Franklin to Mons. Delibard, inclosed in a Letter to Mr. Peter Collinson, F. R. S. Dated Philadelphia, June 29, 1755. p. 305.

You desire my opinion of Pere Beccaria's Italian book. I have read it with much pleasure, and think it one of the best pieces on the subject, that I have seen in any language. Yet as to the article of water-spouts, I am not at present of his sentiments; though I must own with you, that he has handled it very ingeniously. Mr. Collinson has my opinion of whirlwinds and waterspouts at large, written some time since. I know not whether they will be published; if not, I well get them transcribed for your perusal. It does not appear to me, that Pere Beccaria doubts of the absolute impermeability of glass in the sense I mean it; for the instances he gives of holes made through glass by the electric stroke, are such as we have all experienced, and only show that the electric fluid could not pass without making a hole. In the same manner we say, glass is impermeable to water, and yet a stream from a fire-engine will force through the strongest panes of a window. As to the effect of points in drawing the electric matter from clouds, and thereby securing buildings, &c. which, you say, he seems to doubt, I must own I think he only speaks modestly and judiciously. I find I have been but partly understood in that matter. I have mentioned it in several of my letters, and except once, always in the alternative, viz. that pointed rods erected on buildings, and communicating with the moist earth, would either prevent a stroke, or, if not prevented, would conduct it, so as that the building

should suffer no damage. Yet whenever my opinion is examined in Europe, nothing is considered but the probability of those rods preventing a stroke, or explosion; which is only a part of the use I proposed from them; and the other part, their conducting a stroke, which they may happen not to prevent, seems to be totally forgotten, though of equal importance and advantage.

I thank you for communicating M. de Buffon's relation of the effect of lightning at Dijon, on the 7th of June last. In return give me leave to relate an instance I lately saw of the same kind. Being in the town of Newbury in New-England, in November last, I was shown the effect of lightning on their church, which had been struck a few months before. The steeple was a square tower of wood, reaching 70 feet up from the ground to the place where the bell hung, over which rose a taper spire, of wood likewise, reaching 70 feet higher, to the vane or weather-cock. Near the bell was fixed an iron hammer to strike the hours; and from the tail of the hammer a wire went down through a small gimblet hole in the floor that the bell stood upon, and through a second floor in like manner; then horizontally under and near the plastered ceiling of that second floor, till it came near a plastered wall; then down by the side of that wall to a clock, which stood about 20 feet below the bell. The wire was not thicker than a common knitting needle. The spire was split all to pieces by the lightning, and the parts flung in all directions over the square in which the church stood, so that nothing remained above the bell.

The lightning passed between the hammer and the clock in the above-mentioned wire, without hurting either of the floors, or having any effect upon them, except making the gimblet-holes, through which the wire passed, a little larger, and without hurting the plastered wall, or any part of the building, so far as the aforesaid wire and the pendulum wire of the clock extended; which latter wire was about the thickness of a goose-quill. From the end of the pendulum, down quite to the ground, the building was exceedingly rent and damaged, and some stones in the foundation-wall torn out, and thrown to the distance of 20 or 30 feet. No part of the afore-mentioned long small wire, between the clock and the hammer, could be found except about 2 inches, that hung to the tail of the hammer, and about as much that was fastened to the clock; the rest being exploded, and its particles dissipated in smoke and air, as gunpowder is by common fire, and had only left a black smutty track on the plastering, 3 or 4 inches broad, darkest in the middle, and fainter towards the edges, all along the ceiling, under which it passed, and down the wall. These were the effects and appearances: on which I would only make the few following remarks; viz.

1. That lightning, in its passage through a building, will leave wood, to pass as far as it can in metal, and not enter the wood again till the conductor of metal

ceases. And the same I have observed in other instances, as to walls of brick or stone. 2. The quantity of lightning, that passed through this steeple, must have been very great, by its effects on the lofty spire above the bell, and on the square tower all below the end of the clock pendulum. 3. Great as this quantity was, it was conducted by a small wire and a clock pendulum, without the least damage to the building, so far as they extended. 4. The pendulum rod being of a sufficient thickness, conducted the lightning without damage to itself; but the small wire was utterly destroyed. 5. Though the small wire was itself destroyed, yet it had conducted the lightning with safety to the building. 6. And from the whole it seems probable, that if ever such a small wire had been extended from the spindle of the vane to the earth, before the storm, no damage would have been done to the steeple by that stroke of lightning, though the wire itself had been destroyed.

LIII. On the Effects of Lightning at Dorkin in Surrey. By Mr. William Child. p. 309.

Monday, July 16, 1750, a storm arose about 7 o'clock in the evening. During the preceding part of the day the air was of a very red fiery appearance, accompanied with frequent thunderings. About 6 o'clock the wind rose, and blew exceedingly strong, and in a very short time the hemisphere became uncommonly dark; the flashes of lightning were much stronger, and came in very short intervals of time, and the thunder-claps long and loud, attended with a very hard rain for near half an hour, in which time came the strongest flash of lightning he ever saw, and instantly with it the most terrible burst of thunder. Several persons, who were near, saw, at the same time, in different places about Mr. Worsfold's house, large balls of fire, which, as they fell on the houses or ground, divided into innumerable directions.

The lightning entered Mr. Worsfold's house on the south side of the roof, close in a small angle of a stack of chimneys, that stand out several feet above the tiling, and falling perpendicular through the roof, met with a small crank, which was in a passage between the north and south chambers: to which crank hung a bell, and from the crank went a wire both ways into the two chambers. It ran along the wire that went into the back or south chamber, melting it to the end, and when it left it split the post of a bed, that stood in the chamber, as if it had been cleft with wedges. It followed the course of the other wire into the north chamber, which turned towards the east, and went partly round the room, following its direction in every angle where the wire went,* till it reached

* These wires conducting the lightning, as far as they went, confirms Mr. Franklin's opinion, that if they had been extended to the earth, the great damage that ensued might have been prevented. —Orig.

the end, which was joined by a string, to which hung a handle for ringing the bell, it being close by the side of the bed: but the greatest force of the lightning seemed to fall perpendicularly down the side of a wall in the chamber. Against the chimney were hung several barometers, the glasses of which were all shattered to pieces, and forcing away the plastering of the wall, entered the shop, piercing through the two upper shelves, and the parcels of nails, &c. that were on them. And here it is observable, that from the perpendicular course it took the same direction in the shop, as in the chamber over it, but in almost as many lines as there were shelves, leaving very visible marks of its course. Near its perpendicular course in the shop, on one of the shelves, it pierced through 7 box irons, making a small hole about the size of common shot on one side, and leaving a roughness on the opposite side of each box where it came out. The several parcels of nails, tacks, hinges, &c. that lay in the course it took, were very plainly affected by it: some of the small tacks in particular were soldered together, 6, 7, 8, or 10 in a clump, as if scalding metal had run over them. The papers of the parcels were burnt in small holes. At one end of the shelves hung several long pendulums, the springs of which were melted so that they fell to the ground; and the lightning spreading its remaining force to some littered straw and packing paper, that lay about the shop, set fire to them, which was happily extinguished without doing any further damage. Mr. Worsfold was in his shop the whole time, but received no hurt.

LIV. On the great Benefit of Blowing Showers of Fresh Air up through Distilling Liquors. By Stephen Hales, D. D., F. R. S. p. 312.

The great importance of having a sufficient supply of fresh water in ships, has been the occasion of many laudable attempts to make sea-water fresh and wholesome: but all the attempts and discoveries hitherto made have laboured under this great and material objection, viz. the great quantity of fuel that was necessary to distil, with a slow progress, a small quantity of water, by any methods of distillation hitherto known. But Dr. H. had discovered an easy and effectual method to distil great quantities of water with little fuel; which he was led to by the following incidents; viz. Mr. Shipley, secretary of the society for the encouragement of arts, manufactures and commerce, brought him acquainted with Mr. William Baily of Salisbury-court, the author of many ingenious contrivances; who showed him, in a small model of a tin vessel, a method, by which he has happily increased the force of the engine to raise water by fire, viz. by lifting up some of the boiling water, at every stroke, by means of a conical vessel, with small holes in it, full of tow; by which the quantity of the ascending steam was considerably increased. This led him to think, that a greater quantity of liquor might also by this means be distilled; but on trial he found the increase to be only a twelfth

part, though considerable in the expanded form of a steam. Hence he was led to try what would be the effect of causing an incessant shower of air to ascend through the boiling liquor in a still; and this he found on trial to be very considerable. There was another circumstance also, which probably conduced to lead him to this thought, viz. About six months before, Mr. Littlewood, a shipwright at Chatham, came to communicate to him an ingenious contrivance, soon to sweeten stinking water, by blowing a shower of fresh air through a tin pipe full of small holes, laid at the bottom of the water. By this means he said he had sweetened the stinking bilge water in the well of some ships; and also a butt of stinking water in an hour, in the same manner as Dr. H. blew up air through corn and gunpowder, as mentioned in the book on Ventilators.

The method which he used to blow showers of air up through the distilling water, was by means of a flat round tin box, 6 inches diameter, and an inch and half deep; placed at the bottom of the still, on 4 knobs or feet half inch high, to make room for the liquor to spread over the whole bottom of the still, that the heat of the fire may come at it. In larger stills this box must be proportionably larger, and have higher feet. And as the mouth of the still is too narrow for the tin box to enter, which box ought to be within 2 inches as wide as the bottom of the still; therefore the box may be divided into 2 parts, with a hinge at one edge or side, and a clasp at the other, to fix it together, when in the still. This box must be of copper for distilling sea-water. The air-pipe, which passes through the head of the still, will help to keep the air-box from moving to and fro by the motion of the ship; or, if that should not be found sufficient, 3 or 4 small struts may be fixed to the sides of the air-box. They must reach to the sides of the still. The cover and sides of the air-box were punched full of very small holes, a 4th of an inch distant from each other, and about the 20th part of an inch in diameter. On the middle of the cover or lid of this air-box, was fixed a nosil more than half inch wide, fitted to receive, to put on, and take off the lower end of a tin pipe, 20 inches long, and passed through a hole in the head of the still: 4 inches of the upper end of this pipe were bent to a crook, almost at a right angle to the upright stem, to unite the crook to the widened nose of a pair of kitchen double bellows, by means of a short leathern pipe of calves-skin. See pl. 15, fig. 8.

The double bellows were bound fast to a frame, at the upper part of the iron nose, and at the lower handle, the more commodiously to work them. And that the upper half of the double bellows may duly rise and fall, to cause a constant stream of air (besides the usual contracting spiral springs withinside), several flat weights of lead must be laid on the upper part of the bellows, near the handle, with a hole in their middle, to fix them on an upright iron pin fastened on the bellows; that by this means the weights may the more commodiously be put on or

taken off. For, according to the different depths of the liquor in the still, so will the force of the included air, against the upper board of the bellows, be more or less. Wherever the stills are fixed in ships, the air may be conveyed to them from the bellows, either through a small leathern pipe, distended with spiral coils of wire, or through Bamboo canes, or broad small wooden pipes, like hollow fishing rods. In several distillations of a quart at a time, Dr. H. found the quantity distilled by ventilation to be more than the double of that in the usual way. So that the quantity by ventilation may, at a medium, be estimated the double of the usual distillation. It is the well-known property of moving air, to carry along with it a considerable quantity of adjoining vapour, as also of falling water to carry much air down along with it. It is to be hoped therefore, that so considerable an increase in the quantity distilled will be of great benefit to navigation, as it may be done in less time, and with less fire.

In the account of Mr. Appleby's process, for making sea-water fresh, published by order of the lords of the admiralty, in the Gazette of Jan. 22, 1754, it is said that a still, which contains 20 gallons of water, will distil 60 gallons in 10 hours, with little more than one bushel of coals; and therefore 120 gallons in 20 hours, with little more than 2 bushels of coals. And by ventilation 240 gallons, or a tun; and 24 gallons may be distilled in 20 hours, making an allowance for the times of heating those stills full of cold water; and still a larger and wider will distil a tun in 24 hours; which will more than suffice for a sixty gun ship, with 400 men, whose provision of water for 4 months is about 110 tuns. And larger ships may either have proportionably larger stills, or else two of them. As for merchant ships with few men, a small still will be sufficient.

There are holes in the feet of the iron frame or stove of these stills, to screw them down to the deck. They were fixed at the fore-castle before the mast, in King Charles the 2d's time, when they thought they had discovered the way to distil sea-water, free from the noxious spirit of salt, and from the nauseous bitter taste. Or, if it be thought proper, one part of the ship's boiler may be made use of, by adapting a still-head to it.

Doctor Butler, in his lately published method of procuring fresh water at sea, proposes the pouring in more sea-water into the still, through a funnel fixed in a small hole in the head or upper part of the still, when more than half the former water is distilled off; by which means the water in the still will soon acquire a distilling heat; and this to be repeated several times; but then it will be requisite to add each time more chalk, in such proportion as shall be found requisite. It will be well to try this method in hopes to increase the quantity of water distilled. The hole in the head, or upper part of the still, is to be stopped with a small plate of copper, so fixed as to turn to and from over the hole. Doctor Butler used capital soap-lees, in the proportion of a wine quart to 15 gallons of sea-water, which

sufficed for 4 or 5 times repeated pourings-in of more sea-water into the still. But as a small quantity of chalk has the same good effect, and is cheaper, and more easily to be had, it is therefore preferable to soap-lees.

When there is a fire in the cook-room, the sea-water might be ready heated to put into the still, without any additional expence of fuel, in the following manner: about the year 1718, Mr. Schmetou, a German gentleman, got a patent here for heating great quantities of water, with little expence of fuel. Having fixed a spiral iron worm-pipe, in such a brick stove or chimney as women heat their irons in, thus causing the water to run from a vessel, through the worm-pipe, several feet length round, in the fire. About 30 years after, Dr. H. acquainted Mr. Cramond of Twickenham with this, hoping it might be of benefit in distilling sea-water. On which he procured such a spiral iron worm-pipe, about 20 feet long, and $\frac{8}{10}$ inch diameter; the diameter of the spiral coil was about 14 inches. This Dr. H. fixed in a brick stove in his garden, with its upper end fixed to a vessel, which contained 45 gallons of water. He found the event of this first trial to be as follows, viz. When the water ran full bore, at the rate of a gallon in 17 seconds, the heat of the water was found, by a mercurial thermometer held in the stream, at the lower end of the pipe, to be 80 degrees above the freezing point, 180 degrees being the heat of boiling water. When, by means of a turn-cock, a gallon of water was 2 minutes in running, then the heat was 140. At which rate the 45 gallons would be an hour and half in running through the iron pipe; at which rate 25 gallons will run through in 50 minutes, with so considerable a degree of heat; and if it was an hour running, the heat would approach still nearer to a boiling heat, when first put into the still, which would forward the distillation, if wanted.

He pumped the heated water up again into the upper vessel; and thus continued to circulate the heating water, till its heat was 160 degrees in the upper vessel, viz. within 20 degrees, or $\frac{1}{9}$ of boiling, the heat requisite for plentiful distillation. He was in hopes, that if the water in the upper vessel could have been brought to a due degree of heat, and a still-head were fixed on it, with its cooling worm-tub, then water might have been distilled in ships, by having the iron worm-pipe fixed in the chimney of the cook-room: but he found, that when the heat of the water in the upper vessel was 160 degrees; then, in running through the iron worm-pipe again, it was so over-heated as to expand in the pipe, into an explosive vapour, which hindered the running of the water. However he thought it not improper to give an account of this attempt, though it failed.

Now that several effectual means are discovered, to make distilled sea-water wholesome, and also to distil it in much greater quantity in the same still, in the same time, and with nearly the same quantity of fuel; it is reasonable to believe, that it will be of great benefit to navigation, not only in saving much stowage-

room, for other important purposes; but also in procuring fresh sweet wholesome water, instead of stinking putrid water, hitherto used; which must needs have a tendency to promote that putrid distemper, the scurvy. And if due care be taken to exchange for fresh air, the putrid close confined air of ships, which has occasioned the death of millions of mankind; then navigation will become more healthy, and with little more danger to health and life than at land, except from storms.

Dr. H. distilled 3 gallons of sea-water, with the proportion of 6 oz. of Mr. Appleby's lapis infernalis, and 6 oz. of calcined bones to 20 gallons of sea-water, as he directs. This water lathered well with soap, and boiled peas well. He distilled also some sea-water with half an ounce of stone-lime to a gallon, from the Clee hills in Herefordshire, which having been preserved 10 months in a firkin, had slackened to dry powder. This distilled water also lathered well with soap, and boiled peas well; which proves that the lime, which is a fixed body, does not distil over with the water. Afterwards General Oglethorpe informed him, that his father, Sir Theophilus, told him, that lime was one of the ingredients, which he and the rest of the patentees, in Charles the second's time, called the cement, with which they made distilled sea-water wholesome. He distilled also some sea-water with the like proportion of powdered chalk, which boiled peas well, and was better tasted than the waters distilled with lapis infernalis, or lime. He distilled also some sea-water with an ounce of chalk to a gallon, but found no difference in the taste of this, and that which had but half an ounce of chalk to a gallon: so that half an ounce of chalk to a gallon of water will be sufficient; but where the sea-water is salter, or more bituminous, more chalk may be added if needful.

Dr. Alston, of Edinburgh, in the preface to the 2d edition of his Dissertation on Quick-lime and Lime-water, says, That "the like effect was found in distilling sea-water with lime; that it neither precipitated a solution of silver in aquafortis, nor a solution of corrosive sublimate in water, nor did it form a pellicle of various colours on its snrface, as did the water distilled by Mr. Appleby's process." And indeed lime of oyster-shells had the same good effect, but required two distillations, perhaps by using it in too small a proportion. Hence it is probable, that the chalk, the lime, the lime in the lapis infernalis, and the lime in Dr. Butler's soap-lees, seize on and fix not only the bittern salt, but also the bitumen of the sea-water, as we learn from the like effect in the purification of the salt of hartshorn. That the saline spirit arises chiefly from the bittern salt, and not from the more perfect sea-salt, is probable from hence, viz. That in distilled 3 gallons of common water, made as salt as sea-water with common salt; no spirit of salt arose, even though the distillation was carried so far as to leave the salt, though very damp, to lie in heaps, and it was incrusted on the sides of the still, for about 3 inches from the bottom.

It is also a considerable advantage, that water thus distilled by ventilation, being thus replete and freshened with air, has for present use a more agreeable taste than water distilled without ventilation, which requires the standing a longer time to have its more disagreeable adust taste go off. And as the volatile oil of peppermint arises on the wings of the ventilating air during the distillation; so also may that part of the bitumen, which is volatilized by heat; as also the volatile urinous salts of the sea-water, which arise from animal substances, be sublimed in the same manner. It was observable, that the water distilled fast, even though the water in the still was below the surface of the tin airy box, through which the greatest part of the ascending shower of air rushed. Hence the ventilating air, in ascending among the vapours, carries them off fast. Hence it is to be suspected, that this method of ventilation will not do well for simple waters, or fermented vinous spirits; because they being very volatile, much of them may be carried off in waste. It was also observable, that in these distillations of sea-water, no whitish clouds appeared on dropping in solution of corrosive mercury, not even when considerably more than 4 parts in 5 of the water had been distilled over. And it was the same with the mixture of lapis infernalis, lime, and chalk; whence it is probable, that the lime and chalk seize on and fix the more volatile bittern salt, as does also the lime in the lapis infernalis. And it is well known, that sugar, that sweet salt, cannot be made without lime, on which, as its centre of union, it fixes and granulates. And whereas with a solution of silver in aqua-fortis, which was much weakened and diluted with water, there appeared a faint degree of whitish cloud, in all the above-mentioned distillations, though not with the stronger solution of mercury, till the distillation was carried on much beyond 4 parts in 5 of the water in the still; when both solutions caused remarkably white clouds, especially the solution of mercury; which indicates the quantity of the spirit of salt which was raised during the former part of the distillation to be exceedingly small, since it could not seize on, nor disengage the aqua-fortis from the stronger solution of mercury, though it did in a very small degree in the weak solution of silver, so as to let loose a very little of the silver, which thus caused the faint clouds. When a drop of the solution of mercury was dropped into the distilled water, after a drop of the solution of silver, it resorbed the silver cloud, and made the water clear, by means of the great proportion of acid aqua-fortis that was in it.

Now in order to make some estimate of the very small quantity of spirit of salt in these several distilled waters, Dr. H. dropped a drop of the solution of silver into an ounce, or 480 grains of pure rain water, which gave no clouds; but on dropping in a drop of sea-water, which weighed a grain, the white clouds were strong. And since sea-water can dissolve 9 times more salt than it has in it; therefore, supposing the drop to be so fully impregnated with

salt, then the salt would be the 480th part of the ounce of water. But as there is 9 times less salt, therefore the proportion of the quantity of spirit of salt will be but the 4320th part. And how much less must be the proportion of salt in these distilled waters, which is not sufficient to make a sensible impression on solution of mercury, and but a faint one on much diluted solution of silver? Such distilled sea-water will not therefore probably be unwholesome; almost all spring-waters have some degree of salt in them: but if there were more of the spirit of salt, a very small quantity of pot-ash, or pearl-ashes, or salt of tartar, combined with it, will turn it into common salt, the quantity of which would be extremely little.

Since double the usual quantity of vapour may by way of ventilation be carried off, common salt may thus be made much sooner, cheaper, and better; because, as there is much less fire used, so proportionably, less of the fine acid spirit of the salt, in which its virtue consists, will be evaporated away: for it is well known that the salt is best, which has undergone the least action of fire in making. This more speedy method of evaporating will also be useful, in making many other evaporations; as in making pot-ash, &c.

LV. On the Great Benefit of Ventilators in many Instances, in Preserving the Health and Lives of People, in Slave and other Transport Ships. By Stephen Hales, D. D., F.R.S. p. 332.

Captain Thomson, of the Success frigate, in a letter to Dr. Hales, dated London, Sept. 25, 1749, says, "that during the ventilation, the lower deck hatches were commonly kept close shut; by which means the air was drawn down into the hold, from between the decks, through the seams of the ceiling, along the timbers of the ship; by which means they found the foul air soon drawn off from between decks. Their rule for ventilating was for half an hour every 4 hours: but when the ventilating was sometimes neglected for 8 hours together, then they could perceive, especially in hot weather, a very sensible difference by that short neglect of it; for it would then take a longer time to draw off the foul air. Their general rule was, to work the ventilators till they found the air from them sweet. All agreed that they were of great service; the men being so sensible of the benefit of them, that they required no driving to work that, which they received so much benefit by. They found this good effect from ventilation, that though there were near 200 men on board, for almost a year, yet he landed them all well in Georgia, notwithstanding they were pressed men, and drawn out of jails, with distempers upon them. This is what he believes but few transports, or any other ships, can boast of; which he imputes to the benefit received by the ventilators. It is to be remarked, that the crew of this ship, which lay wind-bound for 4 months, with the expedition fleet

which soon after invaded France, were very healthy all the time, when they were very sickly in all the ships of that expedition. This certainly occasioned all kinds of grain provisions to keep better and longer from weevels than otherwise they would have done; and other kinds of provisions received benefit from the coolness and freshness in the air of the ship, which was caused by ventilation."

Mr. Cramond also informed Dr. H. that he found the good effects of ventilators on board a slave ship of his with 392 slaves, 12 of which were taken on board, just before they sailed from Guinea, ill of a flux, which 12 all died; but the rest, with all the Europeans in the ship, arrived well at Buenos Ayres. And a similar letter, on the good effects of ventilation, &c. was also sent by Captain Henry Ellis, who mentions particularly that in one voyage in the year 1755, not one of 312 slaves died; and all his 36 sailors arrived alive and well at Bristol. Also the Earl of Halifax often informed Dr. H. of the great benefit they found by the use of ventilators, in several Nova Scotia transport-ships, 12 to one more have been found to die in unventilated than in ventilated ships. It is indeed a self-evident thing, that the changing the foul air frequently in ships, in which there are many persons, will be a means of keeping them in better health than not doing it. It is the high degree of putrefaction (that most subtile dissolvent in nature), which a foul air acquires in long stagnating, which gives it that pestilential quality, which causes what is called the jail distemper. And a very small quantity, or even vapour of this highly attenuated venom, like the infection or inoculation for the small-pox, soon spreads its deadly infection.

LVI. Of Some Trials to cure the Ill Taste of Milk, which is occasioned by the Food of Cows, either from Turnips, Cabbages, or Autumnal Leaves, &c. Also to Sweeten Stinking Water, &c. By Ste. Hales, D.D., F.R.S. p. 339.

The above method of blowing showers of air up through liquors, will be of considerable use in several other respects, as well as in distillation, as appears by the following trials, viz.

Dr. H. had been informed, that it is a common practice to cure the ill taste of cream from the food of cows, by setting it in broad pans over hot embers or charcoal, and continually stirring it, till scalding hot, and till cool again. But when he attempted to do this much sooner, and more effectually, by blowing showers of air up through it, he soon found it to be impracticable, by reason of its great degree of frothing up. The ill taste must therefore be got out of the milk, before it is set for cream; which he was told had been practised, and that with some benefit, by giving the milk a scalding heat, without stirring it.

May 22, He ventilated some ill-tasted new unheated milk of a cow, which was purposely fed with crow-garlic mixed with cut grass. After 15 minutes ventilation the taste was a little mended; in half an hour's blowing it was something

better. At the hour's end it had the same taste, but was sensibly better than the unventilated milk.

August 23, 4 quarts of ill-tasted new milk, from a cow, which had fed 84 hours on cabbage-leaves only, and drank during that time very little water, were put into a leaden vessel, 8 inches in diameter, and 30 inches deep. The leaden vessel was heated in a large boiler, and set into a vessel of hot water; to give the milk a scalding heat, and also keep it hot. In 10 minutes ventilation it was perfectly cured of its ill taste; and after standing 24 hours in a broad pan, there was a thick scum, which was half cream and half butter, free from any ill taste; the skimmed milk was not sheer or thin: so here is a method to make good butter from ill-tasted milk. The froth of the milk was so great, by reason of a too brisk ventilation, as to make it froth over the vessel, which was 30 inches deep; if it had not been kept down, by constantly lading and breaking the very large bubbles of froth. But when the ventilation is more gentle, the froth has risen but 3 inches from 6 quarts of milk, which was 9 inches deep. The cabbage milk was but 6 inches deep. He repeated the like operation the same day, with the evening milk of the same cow; but giving it only a heat, that he could bear his fingers in, for a little time; with this degree of heat, after 45 minutes ventilation, the milk, though much better tasted, yet was not so completely cured as the former milk. Hence we see how necessary heat is to volatilize the rancid oil (which gives the ill taste) to such a degree as to cause it to fly off by ventilation. It was observed, that what was milked from this cow a week after she had done eating the cabbage, had an ill taste. He had not as yet had an opportunity to try to cure, in the same manner, the ill taste of milk, which is occasioned by cows feeding on autumnal leaves, or turnips.

He ventilated 3 gallons of stinking Jessops well purging water. On first blowing, the smell of the ascending vapour was very offensive, which offensiveness abated much in 5 minutes: in 11 minutes the smell was much better: in 20 minutes the water seemed sweet both in smell and taste; and not sweeter at the end of 45 minutes: 15 or 20 minutes will probably suffice.

July 20th, 3 gallons of stinking sea-water were ventilated; in 5 minutes it was much sweetened, and no ill smell in the ascending air, though at first it was very offensive: at the end of 10 minutes it had a small degree of ill taste; after 20 minutes no ill taste or smell. It frothed near a foot high during part of the ventilation: this from the bitumen, &c.

Some sea-water, which was made to stink with flesh and isinglass being put into it, was not made perfectly sweet, not even by a ventilated distillation, and an hour's more ventilation after it was distilled; so that the putrefaction with animal substances is not easily completely cured by ventilation. When the water was 27 inches deep in the leaden vessel, no air could be blown up through it by

the force of the bellows. But at 18 inches depth the air could freely be blown up in showers, through the water; therefore when it is requisite to blow up through great depths of water, the bellows may be worked with a lever, as smiths' bellows.

As it is found by experience, that the milk and butter of cows, which drink stinking water, has a very bad taste, this plainly shows that the water retains its putrid quality when mixed with the blood. Whence it is much to be suspected, that the stinking water, which is drank in ships, by retaining its putrid quality, even when mixed with the blood, may thereby promote that putrid distemper the scurvy, as well as some other distempers. And much more does the putrid close air in ships, which is mixed with the blood from the lungs, promote putrid and other disorders. By the same means also pestilential infections are taken in: for as the salutary properties of good air are conveyed by the lungs, so are also the malignant qualities of bad air. Thus also the putrid water in marshy aguish countries, may be a cause of agues, as well as the putrid air, which they breathe; which, as well as the putrid water, may probably carry some of its putrid quality into the blood through the lungs. This method therefore of sweetening stinking water, by blowing showers of air up through the stinking water of some aguish places, may be beneficial.*

Live fish may well be carried several miles, by blowing now and then fresh air up through the water, without the trouble of changing the water: for this ventilation will not only keep the water sweet, but also enrich it with air, which is necessary for the life of fishes; with which air they supply their blood, by breathing the water, thin spread, between their gills; but stinking water will kill fish. He also found that much of the heating oil may be got out of tar-water, by blowing showers of air up through it when scalding hot, for 15 or 30 minutes, the longer the better; the less volatile and more salutary acid remaining.

Explanation of the Figures.—Pl. 15, fig. 8, (oopr) a tin or copper air-box, 6 inches diameter, and an inch and a half deep from (o to p).

The lid of the box full of holes, one 20th inch diameter, and about a quarter of an inch distant from each other. (gikl) a nozel soldered to the lid of the air-box, into which the tin pipe (agikl) is fixed so as to take in and out; this pipe to be 2 feet long, and $\frac{6}{10}$ inch diameter. (ab) a bend in the pipe 5 inches long, to which is fastened the leathern pipe (cdef) 6 inches long; to which the nose of the bellows is fixed at (df).

Fig. 9, (giklooxx) the lid of the box, whose rim (oxox), is a quarter of an inch deeper than the box (op fig. 8), that the air-holes (o) may be pierced in its upper part; and the lower part is scolloped with wide scollops, for the air to pass through the holes (pp fig. 8.)

* It has been shown of late years by Mr. Lowitz of Petersburgh, that putrid water may be rendered sweet and wholesome by filtration through pulverized charcoal.

Fig. 10, (ab) the milk-boiler, with the broad rim (cd), and perpendicular rim (cedf) soldered to the horizontal rim; the perpendicular rim to enter the circular groove (ef) 4 inches deep full of sand, to prevent the ascent of the smoke from the fire-stove.

LVII. On the Return of the Comet, expected in 1757, or 1758. By T. Barker, Esq. Dated Lyndon, near Uppingham, Rutland, Dec. 17, 1754.* p. 347.

As we expect the comet of 1531, 1607, and 1682, to return in 1757 or 1758, it is proper to be aware where to look for it. But that will be very different, according to the time of the year it comes; and its period is not sufficiently known to fix the month of its next perihelion, which should be July 25, 1757, according to its last period; but the length of that before would make it Oct. 25, 1758. Mr. B. has therefore, in 12 short tables, given the apparent path of the comet, supposing its perihelion any month in the year, with its curtate distance from the earth; and the first 2 articles of each are the places which it would probably begin to appear in. These will show in general the course of the comet, especially at its first appearance, which is most wanted; but cannot be depended on where its motion is swift, and may be 40° in a day, the beginning of May, or middle of October. From these tables, compared with the scheme, he made another, where the comet would begin to be seen any month in the year.

To construct the places, on a large sheet of pasteboard, he divided the circumference of a circle, of 10 inches radius, into degrees, for the magnus orbis. On the right point of the ecliptic and focal length he drew a parabola like that observed in 1682, round the sun, the centre of the circle, and marked every 4th day's motion from the perihelion, and the line of its nodes. The co-sine of the comet's inclination set off on perpendiculars to this, towards the several points of the parabola, forms the projection of it, or points in the plane of the ecliptic over which the comet is at any time perpendicular.

To find the comet's place at any time, count how long it is before or after its perihelion, and mark the place in the projection of the parabola: lay one edge of a parallel-ruler through that point, and the place the earth is then in, and the other edge passing through the sun, will cut the magnus orbis at the geocentric longitude of the comet: the tangent of the comet's inclination making the perpendicular from the comet's projected place to the line of nodes, the radius is the tangent of its apparent latitude, making the curtate distance of the comet from

* Mr. Barker died at Lyndon, in May 1803, at an advanced age. He was of an ancient and respectable family in Rutland. His father was a celebrated Hebrew scholar, and his mother was daughter of the pious and learned Wm. Whiston, in whose Memoirs may be seen frequent notices of the family. Besides Mr. B.'s regular Annual Registers of the Weather since the year 1771; and several other papers, in the Phil. Trans., he was author of some other separate publications, both on astronomy and theology.

the earth the radius. For expedition thus; draw two lines, making an angle of $17^{\circ} 56'$: on one of them set off the perpendicular from the comet's projected place, and raise a perpendicular to the other; or, which is the same, from the comet's real place in the parabola; and let fall a perpendicular, that is the tangent of the geocentric latitude.

One observation of a known comet will, on such a scheme, determine in some measure its whole course; for, from the earth's place, draw the observed longitude of the comet, where that cuts the projection of the parabola is the comet's place; to which if the observed latitude agrees, it confirms it: then the other data being already known, and one place given, its whole course may be traced. Such a scheme may be also of use to find the periods of comets, where the description of one is not good enough to find its orbit by; for if an old comet was seen in August, in ♒, or in ♋, with south latitude, or very bright in January, it cannot be the comet of 1682; but if in November in ♉, near the ecliptic, it may. It then remains to see, whether the rest of the description will agree with the course it would in that case take; if it does, then, as the account is more or less perfect, there is a greater or less probability of its being the same.

A Table showing where the Comet may be expected to begin to appear any Month.

			Lat.	
January		Scarcely to be seen		
February	end	Retr. between 30° and 15° ♐	Small increasing S.	7 weeks after perihelion.
March	begin	30 and 15 ♑	Small N. or S.	a month after perihelion.
	end	30 and 0 ♒	Small N. decreasing	
April	begin	15 and 0 ♓	Small N. decreasing	2 or 3 weeks after.
	end	Stat. 10 ♈ and 20 ♓	Small N.	
May	begin	middle ♈	N.	about perihelion.
	end	Dir. begin. ♉		1, 2, or 3 weeks.
June	begin	begin. ♉	N. increasing	
	end	end ♉		
July	begin	begin. ♊		2 to 5 weeks before.
	end	middle ♊		
August		end ♊		5 to 8 weeks before.
September		Stat. 25 and 30 ♊	Small increasing N.	2 months before perihel.
October		Retr. end ♊	Small S. or N.	2 or 3 months.
	begin	begin. ♊	Small S.	
Novem.	mid.	5 ♊ and 20 ♉		3 months before perihel.
	end	begin. ♉		
Decem.	begin	begin. ♉ end ♈	Small S. or N. very faint	11 to 14 weeks.
	end	begin. ♈		

LVIII. An Extraordinary and Surprising Agitation of the Waters, though without any perceptible Motion of the Earth, having been observed in various Parts of this Island, both Maritime and Inland, on the same Day, and chiefly about the Time that the more Violent Commotions of both Earth and Waters*

* See the note on the letter from R. Philips.—Orig.

so extensively affected many very distant Parts of the Globe; the following Accounts, relating to the former, were transmitted to the Society; in which are specified the Times and Places when and where they happened.*

1. *At Portsmouth, in Hampshire. By Mr. John Robertson, F. R. S.* p. 351.

On Saturday, Nov. 1, 1755, about 35 minutes after 10 in the morning, there was observed in the dock-yard at Portsmouth, an extraordinary motion of the waters in the north dock, and in the basin, and at two of the jetty-heads. In the north dock, whose length is about 229 feet, breadth 74 feet, and at that time about 17½ feet depth of water, shut in by a pair of strong gates, well secured, his majesty's ship the Gosport of 40 guns, was just let in to be docked, and well stayed by guys and hawsers. On a sudden the ship ran backwards near 3 feet, and then forwards as much, and at the same time she alternately pitched with her stern and head to the depth of near 3 feet; and by the libration of the water, the gates alternately opened and shut, receding from each other near 4 inches.

In the basin, whose length is about 240 feet, breadth 220 feet, and at that time about 17 feet depth of water, shut in by two pair of gates, lay the Berwick of 70 guns, the Dover of 40 guns, both in a direction nearly parallel to the Gosport; and a merchant ship of about 600 tons, unloading tar, lying in an oblique direction to the others. These ships were observed to be agitated in like manner with the Gosport, and the tar-ship to roll from side to side: the swell of the water against the sides of the basin was observed to be 9 inches; one of the workmen measured it between the librations.

The Nassau, a 70-gun ship, lying along side a jetty head, between the north dock and the basin; also the Duke, a 90-gun ship, lying against the next jetty-head, to the southward, both in a direction nearly at right angles to the others, were observed to be rocked in the same manner, but not quite so violently: these 2 ships lay in the harbour. The dock and basin lie nearly east and west, on the west side of the harbour.

2. *In Sussex, and the Southern Parts of Surrey. By Philip Carteret Webb, Esq., F. R. S.* p. 353.

In his garden at Busbridge, near Godalmin in Surrey, on Saturday the first of November 1755, at half an hour after 10 in the forenoon, Philip Smith, John Street, and John Johnson, the gardeners, were alarmed by a very unusual noise in the water, at the east end of the long canal, near which John Street and John Johnson were then at work. On looking that way, they observed the water, in that part of the canal, in great agitation, attended with a considerable

* This agitation of the waters, observed in various parts of Great Britain, happened on the very same day with the memorable earthquake at Lisbon.

noise. The water soon raised itself in a heap or ridge, extending lengthwise about 30 yards, and between 2 and 3 feet above the usual level of the water; after which the heap or ridge heeled or vibrated towards the north, or left side of the canal, with great force, and flowed about 8 feet over the grass walk on that side of the canal, quite up to the arch. On the water's returning back into the canal, it again raised itself into a heap or ridge in the middle; after which the heap or ridge heeled or vibrated with greater force towards the south, or right hand side of the canal, and flowed over the grass walk, and through the rustic arch on that side; and drove a small stream of water, which runs through it, 36 feet back upwards, towards its source. During this latter motion, the bottom of the canal, on the north side, for several feet in width, was quite bare of water. The water being returned into the canal, the vibrations became less and less, but so strong as to make the water flow several times over the south bank of the canal, which is not so high as the north bank. In about a quarter of an hour from the first appearance the water became quiet and smooth as before. The motion of the water was, during the whole time, attended with a great perturbation of the sand from the bottom of the canal, and with a great noise, likened by the gardeners to that of water turning a mill. During the whole time the weather was remarkably still, there not being the least wind; and there was no tremor or motion of the earth felt on the sides of the canal.

The canal is near 700 feet long from west to east, and is about 58 wide: there is a small spring, which constantly runs through it. The water at the east end, where this appearance was observed, usually pens from 2 to 4 feet, being gradually deeper to the west end, where it pens to about 10 feet. No motion was taken notice of in the water at the west end of the canal, the first vibration, which drove the water over the grass walks, was from south to north. The grass walk on the north side of the east end of the canal is 14 inches, and that on the south side about 10 inches higher than the usual level of the water: the highest part of the walk, over which the water flowed, is about 20 inches above the water-level.

Mr. W. was informed, that the water was affected about the same time in the following places. In a mill-pond, at Medhurst in Sussex, the sudden agitation and swell of the water rolling toward the mill was so remarkable, that the miller imagined a sluice had been opened at the upper end of the pond, and had let a back-water into it; but on search it was found to be shut as usual. Below the mill the swell of the water was so great, as to drive the stream upwards, back into the conduit of the mill. At Lee, in the parish of Whitley, in Surrey, about 5 miles from Busbridge, between Busbridge and Medhurst; the water in a canal or pond belonging to Mr. Luff was so violently agitated, that the gardener, on the first appearance, ran for help, thinking a number of otters were under the

water, destroying the fish. In a mill-pond, near Guildford in Surrey, a like swell and agitation of the water was observed by several persons, one of whom stood all the time on a bridge of wood, over the pond. Not the least tremor or motion of the earth was felt in any of these places, or at the bridge at Guildford.

3. *In the Parish of Cobham. By Swithin Adee, of Guildford, M.D., F.R.S.* p. 357.

A man, in the parish of Cobham, was watering a horse in hand, at a pond close by the house, which is fed by springs, and had no current. The time he fixes was about 10 in the morning, but their clock goes too slow. While the horse was drinking, the water ran away from the horse, and moved towards the south with swiftness, and in such a quantity, as left the bottom of the pond bare; then returned with such impetuosity, as made the man leap backwards, to secure himself from the sudden approach of the water. It went back again to the south, with a great swell, and returned again. On inspecting the place, Dr. A. found the water must have risen above 1 foot. The ducks were alarmed at the first agitation, and flew all instantly out of the pond. The man observed, that there was a particular calm at this time of day. You will observe here were two fluxes and two refluxes seen distinctly.

4. *At Medhurst. By Mr. John Hodgson.* p. 358.

As to the ponds near Medhurst, every body agrees, that there was an extraordinary swelling of the water. The water was thrown several feet above its banks, both at north-mill, at south-pond, and the pond in Lord Montacute's park; and at the first of these, on its retreat, left some fishes on dry land.

5. *At Cranbrook in Kent. By Wm. Tempest, Esq. F.R.S.* p. 360.

The people here are very much alarmed on account of an earthquake, which happened last Saturday (Nov. the 1st). I felt nothing of it, but some people fancied they did. I do not hear that the earth moved; only the waters of several ponds, in this and the adjacent parishes, were in such motion, that they overflowed their banks, then returned back, and overflowed the other side.

6. *Near Tunbridge. By John Pringle, M.D., F.R.S.* p. 360.

The pond at Eaton-bridge, near Tunbridge, is about an acre in size, and across it is a post and rail, which is almost quite covered by the water. Some people heard a noise in the water, and imagining something had tumbled in, ran to see what was the matter; when, to their surprise, they saw the water open in the middle, so as that they could see the post and rail a good way down, almost to the bottom, and the water dashing up over a bank about 2 feet high, and perpendicular to the pond. This it did several times, making a great noise. They did not feel the least motion on the shore, nor was there any wind, but a dead calm.

7. *In the River Thames, near Rotherhithe. By Mr. Henry Mills.* p. 361.

Being in one of his barges, unloading some timber, between 11 and 12 o'clock, he was surprised by a sudden heaving up of the barge from a swell of the water, not unlike what happens when a ship is launched from any of the builders' yards in the neighbourhood. After the barge had alternately risen and sunk 3 or 4 times, with a motion gradually decreasing, the water became quiet again.

8. *In Peerless Pool, near Old-street, London. By Tho. Birch, D. D. Secret. R. S.* p. 362.

On the reports, received from several gentlemen, that the agitation of the waters observed in many parts of England, Scotland, Ireland, Holland, &c. on Saturday Nov. 1, 1755, had been likewise noticed in Peerless Pool, near Old-street road, being curious to have as authentic and circumstantial an account as possible of a fact, which he had not heard to have been remarked in any other part of London, or its suburbs, Dr. B. went thither on Saturday Dec. 6, 1755, and took down the following particulars relating to it, from the mouth of one of the two waiters there, who were eye-witnesses of it. He being engaged between the hours of 10 and 11 in the morning, with his fellow-waiter, in some business near the wall inclosing the ground, which contains the fish-pond, and accidentally casting his eye on the water, was surprised to see it greatly moved without the least apparent cause, as the air was quite calm. This occasioned him to call to his companion to take notice of it, who at first neglected it, till being urged to attend to so extraordinary an appearance, he was equally struck with the sight of it. Large waves rolled slowly to and from the bank near them, at the east end, for some time, and at last left the bed of the pond dry for several feet, and in their reflux overflowed the bank 10 or 12 feet, as they did the opposite one, which was evident from the wetness of the ground about it. This motion having continued 5 or 6 minutes, the two waiters stepped to the cold bath near the fish pond, to see what passed there; but no motion was observed in it by them, or by a gentleman who had been in it, and was then dressing himself, and who, on being told of the agitation in the fish pond, went directly thither, with the waiters, and was a third witness of it. On the ceasing of it, they all 3 went to the pleasure bath, between which and the fish pond the cold bath is situated; but they found the said pleasure bath then motionless, but to have been agitated in the same manner with the fish pond, the water having left plain marks of its having overflowed the banks, and risen to the bushes on their sides. The motion in the fish pond had been also observed by some persons in a house belonging to Mr. Kemp, the master of Peerless Pool, situated at a small distance from that pond, and commanding a full view of it.

9. *At Rochford in Essex. By the Rev. Mr. Thomlinson.* p. 364.

At a pond in a close of Mr. Sly's, adjoining to the church-yard, the water was observed to flow a considerable way up the mouth of the pond, and then returning, to flow up the opposite side, repeating this sort of motion for about a quarter of an hour. The motion of the water in the pond was only from east to west, and from west to east, alternately.

10. *In Berkshire, near Reading. By Mr. Rd. Philips.* p. 365.

On the 1st of November last, at about 11 o'clock in the morning, as Mr. Pauncefort's gardener was standing by a fish pond in the garden, he felt a most violent* trembling of the earth, directly under his feet, which lasted upwards of 50 seconds; immediately after which he observed that the water in the pond was in a very unusual motion, and suddenly thrown on the opposite side, leaving that on which he stood quite dry, for the space of 2 yards, and continued in that state for about 2 minutes, when it returned as before, and collecting in or near the middle of the pond, rose about 20 inches above the level of the water on each side, and continued so for 2 minutes in violent agitation, which the gardener described to be like the boiling of a pot.

At the same time Capt. Clarke, at Caversham in Oxfordshire, a mile distant from Reading, was alarmed with a very great noise, as if part of the house had been falling down; on examination however it did not appear that the house was at all damaged; but a vine, which grew against it, was broken off, and 2 dwarf trees, such as are used in espalier hedges, were split by the shock.

11. *Near Reading in Berkshire. By the Rev. J. Blair, LL.D., F.R.S.* p. 367.

At Earley-court, near Reading in Berkshire, in a small fish pond near the house of Edward Pauncefort, Esq. the water was observed, about 11 o'clock in the forenoon, to be in a strong agitation, like that of the tide coming in. The first motion of the water was from the south end of the pond to the north end, leaving the ground or bottom of the fish pond on the south end without water, for the space of 6 feet. It then returned, and flowed at the south end, so as to rise 3 feet up the banks, and immediately went back again to the north, where it likewise flowed 3 feet up the banks; and in the time between the flux and reflux, the water swelled up in the middle of the pond like a ridge, or rising part of the land. This motion or agitation of the water, from south to north, and from north to south alternately, backwards and forwards, lasted about the space of 4 minutes of time; and there seemed to be little or no motion in the direction of east and west, the weather being perfectly calm during the whole time.

* This is the only account that mentions any tremor of the earth to have accompanied the agitation of the waters in this island; and the next account of the very same matter does not take the least notice of any.—Orig.

12. *In Oxfordshire, at Shirburn Castle, the Seat of the Earl of Macclesfield, Pres. R. S. Communicated by his Son, the Lord Viscount Parker, F. R. S. then on the Spot.* p. 368.

On Saturday November 1, a little after 10 o'clock in the forenoon, walking in the garden at Shirburn castle, he perceived the gardener, who was coming towards him by the end of the moat, on a sudden stop short, and look earnestly into the water. He went towards him, and perceived immediately a very strange motion in the water. There was a pretty thick fog, not a breath of air, and the surface of the water all over the moat was as smooth as a looking-glass; yet in that corner of the moat near which he stood, the water flowed into the shore, and retired again successively, in a surprising manner. The flux and reflux were quite regular. Every flood began gently; its velocity increased by degrees, till at last, with great impetuosity, it rushed in till it had reached its full height, at which it remained for a little while, and then again retired, at first gently ebbing, at last sinking away with such quickness, that it left a considerable quantity of water entangled among the pebbles, laid to defend the bank, which run thence in little streams over the shore, now deserted by the water, which at other times always covers it. As the slope of the sides of the moat is very gentle, the space left by the water at its reflux was considerable, though the difference between the highest flood and lowest ebb of these little tides, was but about 4¼ inches perpendicular height; the whole body of water seeming to be violently thrown against the bank, and then retiring again, while the surface of the whole moat all the time continued quite smooth, without even the least wrinkle of a wave. He sent persons to several other ponds, in all which the agitation was very considerable. The swells, that succeeded each other, were not equal, nor did they increase or diminish gradually; for sometimes, after a very great swell, the next 2 or 3 would be small, and then again would come a very large one, followed by 1 or 2 more as large, and then less again.

13. *In Devonshire and Cornwall, at Plymouth, Mounts-Bay, Penzance, &c. By John Huxham, M. D., F. R. S.* p. 371.

Saturday, November 1, about 4 p. m. we had (just about high water) an extraordinary boar, as the sailors call it. The sea seemed disturbed about 20 minutes before, though there was very little wind that day, or for some days before. One of our surgeons, who had then just crossed the ferry at Creston, a mile to the south-east of Plymouth, said, that the tide had made a very extraordinary out (or recess) almost immediately after high water (about 4 p. m.) left both the passage-boats, with some horses, and several persons, at once quite dry in the mud, though the minute or two before, in 4 or 5 feet water; in less than 8 minutes the tide returned with the utmost rapidity, and floated both the boats again, so that they had near 6 feet water. The sea sunk and swelled, though in

a much less degree, for near half an hour longer. It was said, that at the next morning's tide there were several very large surges. This boar drove several ships from their moorings, and broke some of the hawsers, and twirled the ships and vessels round in a very odd manner. At Crunill-passage, over another arm of the sea, about 2 miles west of Plymouth, the same phenomena were observed; and in Stone-house lake, that communicates with that arm of the sea, the boar came in with such impetuosity, that it drove every thing before it, tearing up the mud, sand, and banks, in a very shocking manner, and broke a large cable, by which the foot passage boat is drawn from side to side of the lake.

You will please to observe, that it happened not here till about 4 p. m.; at Portsmouth, about 11 a. m.; in Holland about 11 a. m.; at Kinsale, &c. in Ireland not till 3 or 4 p. m.

14. *On the Coast of Cornwall. By the Rev. William Borlase, of Ludgvan, A. M., F. R. S.* p. 373.

A little after 2 o'clock in the afternoon, about half an hour after ebb, the sea was observed at the Mounts-bay pier to advance suddenly from the eastward. It continued to swell and rise for the space of 10 minutes; it then began to retire, running to the west and south-west, with a rapidity equal to that of a mill-stream descending to an undershot-wheel; it ran so for about 10 minutes, till the water was 6 feet lower than when it began to retire. The sea then began to return, and in 10 minutes it was at the before-mentioned extraordinary height; in 10 minutes more it was sunk as before; and so it continued alternately to rise and fall between 5 and 6 feet, in the same space of time. The 1st and 2d fluxes and refluxes were not so violent at the Mount pier as the 3d and 4th, when the sea was rapid beyond expression, and the alterations continued in their full fury for 2 hours; they then grew fainter gradually, and the whole commotion ceased about low water, $5\frac{1}{2}$ hours after it began.

Penzance pier lies 3 miles west of the Mount, and the reflux was first observed there 45 minutes after 2; the influx came on from the south-east, and south-south-east. Here the greatest rise was 8 feet, and the greatest violence of the agitation about 3 o'clock. Newlyn pier lies a mile west of Penzance. Here the flux was observed first, as at the Mount, and came in from the southward (the eastern current being quite spent) nearly at the same time as at the Mount and Penzance, but in a manner somewhat different; it came on like a surge, or high crested wave, with a surprising noise. The first agitations were as violent as any; and after a few advances and retreats at their greatest violence, in the same space of time as at the Mount, the sea became gradually quiet, after it had risen 10 feet perpendicular at least. This is near 5 feet more than at the Mount pier, and 2 feet more than at Penzance. The agitations of the sea at Moushole, another pier in this bay, did not materially differ from those at Newlyn.

In the little harbour of Heyle, about 4 miles north of the Mount on the Severn sea, the agitation did not make its appearance till an hour and a little more after the ebb began, which must be full an hour later than with us. In this inland half-tide harbour it continued visible but an hour and half; the greatest flux was about the middle of that time, the surge being at that time 7 feet high; but in general it rose and fell but 2 feet only, owing probably to the force and quantity of water being broken in its advances into so retired a creek. At Swansea, in Wales, farther up in St. George's channel, where their ebb is later still than in Heyle, the agitation was proportionably later, and was not observed till after 2 hours ebb, near 3 quarters after 6. At Kingsale, in Ireland, more indeed to the north of us, but more open to the Atlantic ocean than Swansea, and farther to the west, the agitation reached not a full hour after us, but above 2 hours sooner than at Swansea; all tending to show, that the force came from the south and south-west.

What relations these little palpitations, or tremulous rebounds of the sea, had to the dreadful convulsions on the coasts of Spain and Portugal, whether they were the fainter parts of that deplorable shock at Lisbon, or the expiring efforts of some similar subterraneous strugglings of nature farther to the west, under the Atlantic ocean, will remain uncertain, till more facts and dates appear; but by the accounts from abroad, this first of November seems to have been a day of universal tremor to all the sea-coasts of the western parts of Europe.

I would not be thought to suggest, sir, that a shock so far off as the coast of Spain could be so immense, as to propagate a motion of the water quite home to our shores. I should rather imagine, that there were several shocks, and some much nearer to us, but all perhaps from one and the same cause diffused in different portions, and permeating more contracted or dilated, but still communicating passages; I should imagine, that this cause affected the seas and land, in proportion to its own force, and the superior or weaker resistance of the incumbent pressure; that where it found the least resistance of all, there it found its vent, and the swell its cure.

Many other similar accounts were also given, as observed both in the sea and inland lakes: as at Swansea, on the coasts of Norfolk and Lincolnshire, &c.; the lakes in Cumberland; a pond near Durham, at half past 10 o'clock; at Loch Ness, Loch Lomond, &c. in the north of Scotland, about 10 o'clock.

It appears also, by communications sent from abroad, that the like agitations of the water were observed at the Hague, Leyden, Harlem, Amsterdam, Utrecht, Gouda, and Rotterdam, and also at Bois-le-Duc; about 11 o'clock on the 1st of November; and likewise at Kingsale and Cork, in Ireland, between 2 and 3 o'clock.

15. *Of an Extraordinary Alteration in the Baths of Toplitz in Bohemia, on the 1st of November,* 1755. *By Father Joseph Steplin, of Prague.* p. 395.

A report being brought that at Toplitz, a village famous for its baths, and 9 Bohemian miles north-west from Prague, the source of these baths had undergone some change, in order to know the truth of this, Father Steplin requested the president of the Supreme Royal Council to send him an exact account of it, in answer to the several questions which he proposed to him. By this means he procured the following: that in the year 762 those baths were discovered; from which time the principal spring had constantly thrown out the hot waters in the same quantity, and of the same quality. On the 1st of November, 1755, between 11 and 12 in the morning, the chief spring cast forth such a quantity of water, that in the space of half an hour all the baths ran over. About half an hour before this vast increase of the water, the spring became turbid, and flowed muddy; and, having stopped entirely near a minute, broke forth again with prodigious violence, driving before it a considerable quantity of a reddish oker, crocus martialis. After which it became clear, and flowed as pure as before; and continues still to do so; but it supplies more water than usual, and that hotter, and more impregnated with its medicinal quality.

16. *Concerning the Agitation of the Waters, Nov.* 1, 1755. *By Mr. De Hondt, of the Hague.* p. 396.

We had at 11 o'clock a phenomenon, which astonished every body. In absolutely calm weather there was observed of a sudden so violent a motion in the water, that the ships were struck against each other, and broke the cables which fastened them. It was felt at the same time at the Hague, Leyden, Harlem, Amsterdam, Gouda, Utrecht, Rotterdam, and Bois-le-duc. At the Hague it was but slight; and no motion was felt in the ground.

17. *On the same. By M. Allamond, Professor of Philosophy at Leyden, and F.R.S.* p. 397.

Between half an hour after 10 and 11 in the morning, in some of the canals of this city, the water rose suddenly on the quay, situated on the south. It returned afterwards to its bed, and made several very sensible undulations, so that the boats were strongly agitated. The same kind of motion was perceived here in the tuns of water of 2 brewhouses, and in those of 3 brewhouses at Harlem. The branches of the Roman Catholic church at Rotterdam, which hung from long iron rods, made several oscillations. A tallow-chandler at the Hague was surprised to hear the clashing noise made by all the candles hung up in his shop.

The accounts brought from Norway inform us, that the same observations were made there, almost at the same time.

LIX. *An Account of the Earthquake, Nov.* 1, 1755, *as felt in the Lead Mines in Derbyshire. By the Rev. Mr. Bullock.* p. 398.

The following is an account of the earthquake, which happened at the lead mines on Eyam-edge in the peak of Derbyshire, on Saturday the 1st of Nov. 1755, about 11 o'clock in the forenoon.

Francis Mason, the overseer, says, That he sat in a little room, about 40 yards from the mouth of one of the engine shafts. He felt one shock, which very sensibly raised him up in his chair, and caused several pieces of lime or plaster to drop from the sides of the room. In a field about 300 yards from the mines, there had happened a chasm or cleft on the surface of the earth, which was supposed to be made at the same time he felt the shock; its continuation from one end to the other, was near 150 yards, being parallel to the range of the vein on the north side: the depth of it was about 8 or 9 inches, and its diameter 4.

Two miners say, that at the aforesaid time they were employed in carting, or drawing along the drifts the ore and other minerals to be raised up the shafts. The drift where they were working, is about 60 fathoms, or 120 yards deep, and the space of it from one end to the other upwards of 50 yards. They were suddenly surprised by a shock, which greatly terrified them. They durst not attempt to climb the shaft, lest that should be running in on them, but consulted what means to take for their safety. While they were thinking of some place of refuge, they were alarmed by a shock much more violent than the former; which put them in such a consternation, that they both ran precipitately to the other end of the drift. Soon after they were again alarmed by a third shock; which, after an interval of about 4 or 5 minutes, was succeeded by a fourth; and about the same space of time after, by a fifth; none of which were so violent as the second. They heard after every shock a loud rumbling in the bowels of the earth, which continued for about half a minute, gradually decreasing, or appearing at a greater distance. They imagined, that the whole space of time, from the first shock to the last, was about 20 minutes. They remained about 10 minutes in the mine after the last shock; when they thought it advisable to examine the passages, and to get out of the mine, if possible. As they went along the drifts, they observed, that several pieces of minerals had dropped from the sides and roof, but all the shafts remained entire, without the least discomposure. The space of ground at the mines, wherein it was felt, was 960 yards, being all that was at that time in work.

2. *Account of the Earthquake at Lisbon,** *Nov.* 1, 1755, *in Two Letters from Mr. Wolfall, Surgeon.* p. 402.

Since the beginning of the year 1750, we have had much less rain than has

* This city suffered greatly by an earthquake in 1531.—Orig.

ever been known in the memory of man, excepting the last spring: the summer has been cooler than usual, and for the last 40 days, fine clear weather, but not remarkably so. On the first instant (Nov. 1755,) about 40 minutes past 9 in the morning, was felt a most violent shock of an earthquake: it seemed to last about the 10th part of a minute, and then came down every church and convent in town, together with the King's palace, the magnificent opera-house, joining to it; in short, there was not a large building in town that escaped. Of the dwelling houses, there might be about one-fourth of them that tumbled, which, at a very moderate computation, occasioned the loss of thirty thousand lives. The shocking sight of the dead bodies, with the shrieks and cries of those who were half buried in the ruins, are only known to those who were eye-witnesses. It far exceeds all description, for the fear and consternation was so great, that the most resolute person durst not stay a moment to remove a few stones off the friend he loved most, though many might have been saved by so doing: but nothing was thought of but self-preservation; getting into open places, and into the middle of streets, was the mot probable security. Such as were in the upper stories of houses, were in general more fortunate than those that attempted to escape by the doors; for these were buried under the ruins with the greatest part of the foot-passengers: such as were in equipages escaped best, though their cattle and drivers suffered severely; but those lost in houses and the streets, are very unequal in number to those that were buried in the ruins of churches; for as it was a day of great devotion, and the time of celebrating mass, all the churches in the city were vastly crowded, and the number of churches here exceeds that of both London and Westminster; and as the steeples are built high, they mostly fell with the roof of the church, and the stones are so large, that few escaped.

Had the misery ended here, it might in some degree have admitted of redress; for though lives could not be restored, yet the immense riches that were in the ruins, might in some part have been digged out: but the hopes of this are almost gone, for in about 2 hours after the shock, fires broke out in 3 different parts of the city, occasioned by the goods and the kitchen-fires being all jumbled together. About this time also the wind, from being perfectly calm, sprung up a fresh gale, which made the fire rage with such fury, that at the end of 3 days all the city was reduced to cinders. Indeed every element seemed to conspire to our destruction; for soon after the shock, which was near high water, the tide rose 40 feet higher in an instant than was ever known, and as suddenly subsided. Had it not so done, the whole city must have been laid under water. As soon as we had time for recollection, nothing but death was present to our imaginations. For 1st, the apprehensions of a pestilence from the number of dead bodies, and the general confusion, and want of people to

bury them, were very alarming: but the fire consumed them, and prevented that evil. 2d. The fears of a famine were very great; for Lisbon is the store-house for corn to all the country, for 50 miles round: however, some of the corn-houses were happily saved, and though the 3 succeeding days to the earth-quake an ounce of bread was worth a pound of gold, yet afterwards bread became moderately plenty, and we were all happily relieved from our starving condition.

The 3d great dread was, that the low villainous part of the people would take an advantage of the confusion, and murder and plunder those few who had saved any thing. This in some degree happened; on which the King gave orders for gallows immediately to be placed all round the city; and after about a hundred executions, among which were some English sailors, the evil stopped. We are still in a state of the greatest uncertainty and confusion, for we have had in all 22 different shocks since the first, but none so violent as to bring any houses down in the out-skirts of the town, that escaped the first shock; but nobody yet ventures to lie in houses; and though we are in general exposed to the open sky for want of materials to make tents, and though rain has fallen several nights past, yet the most delicate tender people suffer their difficulties with as little inconvenience as the most robust and healthy. Every thing is yet with us in the greatest confusion imaginable: we have neither clothes nor conveniences, nor money to send for them to other countries. All Europe is deeply concerned in the immense riches and merchandises that are lost, but none so much as our own nation, who have lost every thing they had here. Few English lives have been lost in comparison of other nations, but great numbers wounded; and though we have 3 English surgeons here, but unfortunately without either instruments, bandages, or dressings, to relieve them. Two days after the first shock, orders were given to dig for the bodies, and a great many have been taken up and recovered. Mr. W. lodged in a house where there were 38 inhabitants, and only 4 saved. In the city prison 800 were lost. 1200 in the general hospital, a great number of convents of 400 in each lost; the Spanish ambassador with 35 servants. It fortunately happened, that the King and the Royal Family were at Belime, a palace about a league out of town. The palace in town tumbled the first shock, but the natives insist that the inquisition was the first building that fell down. The shock has been felt all over the kingdom, but along the sea-side more particularly. Faro, St. Ubals, and some of the large trading towns are, if possible, in worse situation than here; though the city of Porto has quite escaped.

It is possible, that the cause of all these misfortunes came from under the western ocean; for a captain of a ship, a very sensible man, told him that he was 50 leagues off at at sea; that the shock was there so violent as greatly to injure the deck of his ship; it occasioned him to think that he had mistaken

his reckoning, and struck upon a rock, and they instantly hawled out their long-boat to save themselves, but happily brought the ship, though much injured, into this harbour.

The shocks lasted between 5 and 7 minutes. The very first shock was extremely short, but then it was as quick as lightning succeeded by two others, which, in the general way of speaking, are mentioned all together as only one shock. About 12 o'clock we had a second shock. Mr. W. was then in the Terra do Paço, or King's palace-yard, and had an opportunity of seeing the walls of several houses that were standing, open from top to bottom, more than a quarter of a yard, yet close again so exactly as to leave no signs of injury.

3. *Abstract of Two Letters, by John Mendes Saccheti, M. D., F. R. S. dated from the Fields of Lisbon, on the 7th of November, and the 1st of December,* 1755. p. 409.

The day before the fatal earthquake the atmosphere, and light of the sun, had the appearance of clouds and notable offuscation, and more strong and visible at the actual time of the great shock, which was by undulation, and lasted from 6 to 8 minutes. It ruined not only this populous city, but all the southern part of the country of Estremadura, and a great part of the kingdom of Algarve. The earth opened in fissures in several parts, but neither fire nor visible smoke came out of it. The water in the sea rose several times, and in a few minutes made 3 fluxes and refluxes, rising above the greatest spring-tides 2 spawns, or 15 English feet.

4. *Abstract of a Letter from Mr. J. Latham, dated at Zsu-queira, Dec.* 11, 1755, *to his Uncle in London.* p. 411.

I was on the river on Saturday the 1st of November, with a gentleman going to a village 3 miles off. In a quarter of an hour the boat made a noise as if on the shore or landing. About 4 or 5 minutes after, the boat made a noise as before, which was another shake. We saw the houses tumble down on both sides of the river. In Lisbon, a convent on a high hill fronting the river, the most part of it came down, a great many were killed and buried in the ruins; many tumbled neck and heels in the water, others ran down to the river, up to their middle and necks. A strong northerly wind blew from shore, which covered the water with dust, and in our boat we could scarcely see one another; and it entirely hid the sun from us for some time. The wind soon dispersed the dust, the shaking seemed over. In about three quarters of an hour we came to the village, where we were called ashore, and met several gentlemen, who came out of the city on horse-back, but so frighted, that they did not know what was the matter. In a quarter of an hour after our landing, the village was alarmed with another shake. We got down to our boat; in a moment the river rose so

high as obliged us to take to our heels, and run for our lives into the fields and high ground, the water flowing across the road, which, from the low tide, was above a quarter of a mile; the ships were whirled about, and several people taken into the water, others driven ashore and dashed to pieces. From the high grounds we could see the sea at about a mile's distance come rushing in like a torrent, though against wind and tide. A fine new stone quay in Lisbon, where the merchants land their goods, where at that time about 3 thousand people were got out for safety, was turned bottom upwards, and every one lost; nor did so much as a single body appear afterwards. It being a holy-day, great numbers of the natives being at their devotion in convents and churches, whose large buildings suffered most, it is computed about 60 thousand souls, and a hundred and odd of the foreigners, and all sorts of cattle perished. The religious houses being illuminated with wax-lights, and the images dressed, by the shakes were set on fire by night, in several places, and by Monday morning entirely consumed, with the rich furniture of convents, nunneries, and nobility's houses, and all the merchants and tradesmen's goods, besides jewels, gold, plate, and coined money. There have been a great many shakes by nights and days: even on the 8th of December was felt a strong one: it was much more violent in some places than others. The ground was opened; in some places you might put your hand down broad-ways, and not feel the bottom with a long stick. A sea port, called St. Ubal's, was entirely swallowed up, people and all.

5. *Observations made at Colares,* on the Earthquake at Lisbon, of the 1st of November 1755, by Mr. Stoqueler, Consul of Hamburg.* p. 413.

The 1st of November, the day broke with a serene sky, the wind continuing at east; but about 9 o'clock the sun became dim, and about half an hour after we began to hear a rumbling noise, like that of carriages, which increased to such a degree as to equal the noise of the loudest cannon; and immediately we felt the first shock, which was succeeded by a 2d and 3d; on which, as also on the fourth, were seen several light flames of fire issuing from the sides of the mountains, resembling what is observed on the kindling of charcoal. In the spot on which he remained till the 3d shock was over, he observed the walls to move from east to west.

In the afternoon of the 31st of October, the water of a fountain was greatly decreased: on the morning of the 1st of November it ran very muddy, and after the earthquake it returned to its usual state, both in quantity and clearness. Some fountains, after the earthquake, ran muddy, some decreased, others increased, others were dried up; and one, that with the earthquake was

* It is about 20 miles from Lisbon, and lies behind the rock, about 2 miles from the sea.—Orig.

dried up entirely, returned 2 days after to its usual state. In some places where there was no water, springs burst forth, which continued to run. On the spot of Varge, and river of Macaas, at the time of the earthquake, many springs of water burst forth, and some spouted to the height of 25 palms,* throwing up sand of various colours, which remained on the ground. On the hills, numbers of rocks were split, and there were several rents in the ground, but none considerable. On the coast pieces of rock fell, some of them very large, and in the sea sundry rocks were broken: the most noted are those called by the sailors Sarithoes, or Biturecras, of which one was only broken off at the summit, the other all to pieces.

Between these rocks and the main, the coasting vessels sailed at low water; and now you may go to them at low water, without wetting your feet. From the rock called Pedra de Alvidrar, a kind of parapet was broke off, which issued from its foundation in the sea. In a swamp or lake, which received a good deal of water in winter, and was not dry in summer, the earth rose; for there is now scarcely the appearance of a hollow, which was before to the depth of six or seven palms; it now remains even with the adjacent ground. In other places, by the change of the currents it appears that the earth was moved, so that some spots are more elevated, others more depressed than before.

6. *Concerning the Earthquake at Oporto in Portugal, Nov. 1, 1755. By a Letter from that Place.* p. 418.

Saturday Nov. 1st, we had such a terrible earthquake here, that we were afraid of being swallowed up alive, though it has done but very little damage. It began about half an hour past 9 o'clock in the morning, like thunder, or rather the rattling of a coach over stones, and my own house, as well as most other people's, during the first shock, which was a very terrible one indeed, was just as if in a convulsion, which lasted 7 or 8 minutes, and every thing shook and rattled in it all the time, as if it was coming down; which frightened people so much, that a great many ran into the streets, where I plainly saw the earth heave up. At 6 o'clock at night there was another great shock. The river also rose and fell surprizingly every quarter of an hour, for upwards of 4 hours at least, 4 or 5 feet, and sometimes more; and some saw the river in some places open, and throw out a vast deal of wind, which was very terrifying.

Abstract of Two Letters to Mr. Plummer, Merchant in London, from Oporto, concerning the Earthquake felt there. p. 419.

This morning, Nov. 1, 1755, between 9 and 10 o'clock, this city was alarmed with the terrible shock of an earthquake, which continued violently for 5 or 6 minutes, but has done no further damage than the overturning some pedestals

* The Portuguese palm is about 9 inches.—Orig.

from the tops of some churches, and splitting the walls of some old houses. The shock was perceived in the river, among the shipping, by a sudden flux and reflux of the tide, but no damage was done. During the time of the earthquake, and indeed preceding it, was heard a hollow dreadful noise.

Abstract of a Letter from Madrid to the Spanish Consul in London. p. 423.

Nov. 1, soon after 10 o'clock, there was very sensibly felt a great earthquake: according to the common opinion, it lasted 5 or 6 minutes. Every one at first thought that they were seized with a swimming in their heads; and afterwards that their houses were falling. The same happened in the churches, so that the people trod each other under foot in getting out; and those who observed it in the towers were very much frightened, thinking that they were tumbling to the ground. It was not felt by those who were in their coaches, and very little by those who walked on foot.

Of the Earthquake at Cadiz, Nov. 1, 1755, *in a Letter from Mr. Benjamin Bewick, Merchant there.* p. 424.

Nov. 1, just before 10, the whole town was shaken with a violent earthquake, which lasted above 3¼ minutes. The water in the cisterns, which are underground, washed backward and forward, so as to make a great froth upon it. Every body ran out of the houses and churches, in a terrible consternation, but no damage was done, as all the buildings here are excessively strong. An hour after, looking out to sea, we saw a wave coming at 8 miles distance, which was at least 60 feet higher than common. Every body began to tremble; the centinels left their posts, and well they did: it came against the west part of the town, which is very rocky; the rocks abated a great deal of its force. At last it came upon the walls, and beat in the breast-work, and carried pieces of 8 or 10 tons weight, 40 and 50 yards from the wall, and carried away the sand and walls, but left the houses standing, so that only 2 or 3 persons were drowned. Every one now thought the town would be swallowed up; for though this was run off, yet with glasses we saw more coming. When the wave was gone, some parts, that are deep at low water, were quite dry, for the water retired with the same violence that it came with. These waves came in this manner 4 or 5 times, but with less force each time; and about one the sea became more calm, but was still in a boiling motion. Every thing was washed off the mole. The bay was full of barrels, and boats, and timber; but no damage was done to the shipping. The walls have suffered very much. Some of the towns about us have suffered a great deal more than we, by the falling of houses and towers.

Of the Earthquake at Cadiz. By Don Antonio d'Ulloa, F.R.S. p. 427.

Nov. 1, we had here an earthquake, the violence of which was not inferior to that which swallowed up Lima and Callao, in Peru, towards the end of October 1746. It happened in very fine weather, at 3 minutes after 9 in the morning,

and continued 5 minutes, and consequently near twice as long as that of Peru, the duration of which was only 3 minutes. If every thing was not destroyed here, it seems particularly owing to the solidity of the buildings. The inhabitants had scarcely begun to recover from their first terror, when they saw themselves plunged into new alarms. At 10 minutes after 11 they saw rolling towards the city a tide of the sea, which passed over the parapet of 60 feet above the ordinary level of the water. At 30 minutes after 11 came a 2d tide; and these 2 were followed by 4 others of the same kind, at 50 minutes after 11, at 12 o'clock 30 minutes; 1 o'clock 10 minutes; and 1 o'clock 50 minutes. The tides continued, with some intervals, till the evening, but lessening. They have ruined 100 toises of the rampart; part of which of 3 toises length, and of their whole thickness, were carried by the torrent above 50 paces. A great number of persons perished on the causey, which leads to the isle of Lesu. Seville has been greatly damaged. St. Lucar and Cheres have likewise suffered much; and Conel is said to be entirely destroyed.

An Account of the Earthquakes that happened in Barbary, inclosed in a Letter from General Fowke, Governor of Gibraltar. Communicated by Philip Lord Viscount Royston, F.R.S. p. 428.

At Tetuan the earthquake began, the 1st of November, at 10 in the morning, and lasted between 7 and 8 minutes; during which space the shock was repeated 3 different times, with such violence, that it was feared the whole city would fall down; but the only damage that resulted was the opening or parting of some of the walls of sundry houses. It was likewise observed that the waters of the river Chico, on the other side of the city, and those of a fountain, appeared very red.

At Tangier, the earthquake began about the same time, but lasted longer than at Tetuan; the trembling of the houses, mosques, &c. was great, and a large promontory of an old building near the city gate, after 3 shocks, fell down to the ground, by which 5 shops were demolished; the sea came up to the very walls, a thing never seen before, and went down directly with the same rapidity as it came up, as far as the place where the large vessels anchor in the bay, leaving upon the mole a great quantity of sand and fish. These commotions of the sea were repeated 18 times, and continued till 6 in the evening, though not with such violence as at the first time. The fountains were dried up, so that there was no water to be had till night: and as to the shore-side, the waters came up half a league inland.

At Arzila, it happened about the same time, but the damage was not great. At the coming up of the sea 7 Moors, who were out of the town walls, were drowned; and the waters came in through one of the city gates very far. The water came up with such impetuosity, that it lifted up a vessel in the bay

which, at the water's falling down to its centre again, fell down with such a force upon the land, that it was broke to pieces; and a boat was found at the distance of 2 musket-shots within land from the sea.

At Salle, there happened very great damage, several houses having fallen down. The waters came up with such rapidity, that they came into the city, and at their falling down, great quantities of fish were found in the streets, and many persons were drowned: 2 ferry-boats overset in the river, and all the people on board were also drowned; and a great number of camels, that were just then going for Morocco, were carried away by the waters.

At Fez, vast numbers of houses fell down, and a great many people were buried under the ruins. At the Scloges, a place where the Barbarians live, not far from Fez, a mountain broke open, and a stream issued out as red as blood.

At Mequinez, a vast number of houses fell down, and a great many people of both sexes were buried under their ruins; the convent of the Franciscan friars fell down to the ground, but the friars were saved.

At Saffe, several houses fell down, and the sea came up as far as the great mosque, which is at a great distance from the sea.

At Morocco, by the falling down of a great number of houses many people lost their lives; and about 8 leagues from this city, the earth opened, and swallowed up a village, with all the inhabitants, (who were known by the name of the sons of Busunba) to the number of about 8 or 10,000 persons, with their cattle of all sorts, as camels, horses, horned cattle, &c. and soon after the earth was closed again, in the same manner as it was before.

At Fez and Mequinez, on the 18th of November there happened another earthquake, which was more violent than the first, and lasted till break of day the 19th; during which time great numbers of houses fell down at Fez; many people of both sexes were buried under their ruins; and as to Mequinez, there are but few houses left standing. The people killed by the falling of the houses, besides the wounded, are numberless; and in the part of the town called the Jews' Habitation, only 8 persons were saved.

At Sarjon Hills, one of the hills was rent in two; one side of which fell on a large town, where there was the famous sanctuary of their prophet, known by the name of Mulay Teris; and the other side of the said hill fell down on another large town, and both towns and the inhabitants were all buried under it.

The famous city of Tasso was wholly swallowed up; no remains left.

This last earthquake was likewise felt at Tetuan and Tangier, but without any other damage than that the fountains of Tangier were dried up for 24 hours.

Of the Earthquake in the Island of Madeira, Nov. 1, 1755, in a Letter from Dr. Tho. Heberden, to his Brother Dr. Wm. Heberden, F.R.S. p. 432.

Nov. 1, 1755, in the city of Funchal, on the island of Madeira, at half an

hour past 9 o'clock in the morning, was perceived a shock of an earthquake. The first notice was a rumbling noise in the air, like that of empty carriages passing hastily over a stone pavement; immediately the floor moved with a tremulous motion, vibrating very quickly; the windows rattled, and the whole house seemed to shake. The shock lasted a full minute; during which the vibrations, though continual, abated and increased twice very sensibly, in point of force. The noise in the air, which had preceded the shock, continued to accompany it; and lasted some seconds after the motion of the earth had entirely ceased; dying away like a peal of distant thunder rolling through the air. The direction of the shock seemed to be from east to west.

About an hour and half after the shock had ceased, the sea, which was quite calm, was observed to retire suddenly some paces, and rising with a great swell, without the least noise, as suddenly advancing, overflowed the shore, and entered into the city. It rose full 15 feet perpendicular above high water mark, though the tide, which ebbs and flows here 7 feet, was then at half ebb. The water immediately receded again, and after having fluctuated 4 or 5 times between high and low water mark, the undulations continually decreasing, it subsided, and the sea remained calm.

In the northern part of this island the inundation has been more violent, the sea there retiring at first above 100 paces, and suddenly returning, overflowed the shore, destroying or damaging several houses and cottages, forcing open doors, and breaking down the walls of several stores or magazines, and carrying away in its recess a considerable quantity of grain, &c. Great quantities of fish were left on the shore, and in the streets of the village of Machico. All this has been the effect of one sole undulation of the sea, it never flowing afterward so high as high water mark; though it continued fluctuating much longer there, before it subsided, than here at Funchal, as the fluctuation and swell was much greater here than it had been farther to the westward, where in some places it has been hardly, if at all, perceptible.

Another Account of the same Earthquake at Madeira. By Mr. Charles Chambers. p. 435.

This account contains no other particulars than the foregoing.

Of the late Earthquakes of Nov. 1, and Dec. 9, 1755, as felt at Neufchatel in Swisserland. By Mons. De Vautravers, F.R.S. p. 436.

The dreadful earthquake of the 1st of November last has been perceived even in this country, though very faintly. It turned some of our rivers suddenly muddy, without any rain, and swelled our lake of Neufchatel to the height of near 2 feet above its natural level, for the space of a few hours.

The 9th of this month (Dec.) we felt a much more severe shock of an earthquake. It happened a little before 3 o'clock in the afternoon, with a vibratory

motion from west to east; another from east to west, and a third from west to east again. Some chimnies fell in at Cudrefin; the bell in the tower at Morat rung 2 strokes. The shock was severer in lofty places than it was in low grounds. The lake of Morat, immediately after the earthquake, sunk 3 inches, and remains still in the same depression. The same earthquake was felt the same day, at the same hour, at Basil, Berne, Fribourg, Geneva, and all over Swisserland; as likewise at Besançon in France.

Of the Earthquake felt at Geneva, Dec. 9, 1755. *By Mons. Trembley.* p. 438.

The earthquake of Nov. 1, was felt at Lyons. It is said that the waters retired for some moments at the end of the lake of Geneva; and that a motion was observed in those of the lake of Zurich. On the 9th of this month, (Dec.) a little before half an hour after 2 in the afternoon, in very fine and very calm weather, there was felt here in all the houses in general a very great shock of an earthquake; but it did no damage. The motion was particularly remarked in looking-glasses and windows. Those who were sitting perceived that their chairs shook; and many thought that they were going to fall. The sick felt the motion in their beds. The bells in the rooms of several houses rang. The bell of the clock in the tower of the isle of Rhone rung several times. The motion was felt even on the ground floor of houses. It was felt at Nion, Morges, Lausanne, Berne, Zurich, and perhaps more strongly than here. Three shocks were in fact felt within the space of about a minute. During the first a noise was heard like that of a cart passing over a pavement.

Of the Earthquake felt at Boston in New-England, Nov. 18, 1755. *Communicated by John Hyde, Esq. F.R.S.* p. 439.

Tuesday, Nov, 18, 1755, about half an hour past 4 in the morning, Mr. H. was awaked by the shaking of his bed and the house; the cause of which he immediately concluded could be nothing but an earthquake, having experienced one before. The trembling continued about 2 minutes. Near 100 chimnies are levelled with the roofs of the houses: many more, probably not fewer than 12 or or 1500 are shattered, and thrown down in part; so that in some places, especially on the low loose ground, made by encroachments on the harbour, the streets are almost covered with the bricks that have fallen. Some chimnies, though not thrown down, are dislocated, or broken several feet from the top, and partly turned round, as on a swivel; some are shoved on one side horizontally, jutting over, and just nodding to their fall: the gable ends of several brick buildings, perhaps of 12 or 15, are thrown down, and the roofs of some houses are quite broken in by the fall of the chimnies: some pumps suddenly dried up; the convulsions of the earth having choaked the springs that supplied them, or altered their course. Many clocks were also stopped by being so violently agitated.

Of the Earthquake felt in New York, November 18, 1755, *in a Letter from Cadwallader Colden, Esq.* p. 443.

A few minutes past 4 in the morning, Mr. C. was awaked with the shock of the earthquake. He plainly heard the noise like that of carts on pavements, going to the eastward, with now and then a noise like the explosion of a great gun at a distance. It was felt about 4 o'clock at Philadelphia, and half after 4 at Boston, and was more violent to the eastward than the westward, and there was an eruption at a place called Scituate, about 20 or 30 miles to the southward of Boston. The summer and autumn had been unusually dry for some days before the earthquake, though the sky was perfectly calm and serene, the air was so light, that the smoke of the town by falling down was offensive to our eyes, as we walked the streets. In the last remarkable earthquake, which happened about 17 years before, and nearly at the same time of the year, the weather preceding it was much the same as now, attended with the falling of the smoke in the town.

Of the Earthquake felt in Pennsylvania, Nov. 18, 1755, *in a Letter to Mr. Peter Collinson, F. R. S.* p. 444.

Abour 4 o'clock this province was pretty generally alarmed with the shock of an earthquake. It gradually increased for 1 minute to such a degree as to open the chamber door, by drawing the bolt of the lock out of the staple. Some people thought they felt its continuance 5 or 6 minutes, but the writer thinks it did not exceed 1, nor was it less. He felt the shock of the 2 earthquakes in England; but they were little in comparison to this.

LX. Of Four Undescribed Fishes of Aleppo. By Alex. Russel, * *M. D.* p. 445.

Of these fishes Dr. Russel brought the drawings and descriptions from Aleppo.

* Alexander Russel, M.D. was born in the city of Edinburgh about the year 1714; where his father practised the profession of the law with great reputation. After the usual course of grammatical study in the High School at Edinburgh, and afterwards in the University, he was placed with his uncle, an eminent physician in the same city. In the years 1732, 3, and 4, he attended the lectures of the various professors, and having finished his studies, he settled about the year 1740, at the city of Aleppo, where he was greatly esteemed by the English factory. He acquired great celebrity in his profession, and was frequently consulted, not only by the Greek, Armenian, and Jewish inhabitants of that region, but even by the Turks themselves, who are said to have held him in high esteem, and to have placed great confidence in his opinion.

In 1755 he returned to Britain, and settled in London, where he composed his well-known work the History of Aleppo, of which a second edition has lately been published under the care of his brother the late Dr. Patrick Russel, author of the splendid work on Indian Serpents and Fishes. To Dr. Alexander Russel we owe the introduction of the true scammony, as well as that highly elegant shrub the arbutus andrachne into the Botanic Gardens of England. About 1759 he was chosen physician to St. Thomas's Hospital, and was also elected a F.R.S. He attained a very considerable degree of eminence in his profession, and maintained a great integrity of character. He died Nov. 28, in the year 1768.

Fig. 11 and 14, pl. 15, seem to be quite new genera; and 12 and 13, though they belong to the same genus with the mystus, described by Gronovius in his Mus. Ichthyologic. p. 34, N° 83, and p. 35, N° 84, yet are species of that fish which has not hitherto been described.

The fish, fig. 11,* resembles much in shape the Silurus Rondeletii, and has no scales. Its length, from the nose to the tip of the tail, is 20 inches; weight 20 oz.; but they are of different sizes. The head and back are of a black colour. The lateral line runs quite from the head to the tail, on the middle of the side; below which, to the belly, the colour gradually changes into a dark purple; of the same colour is the under part of the head. The head is flat, and near 5 inches in length. The body roundish, till within a few inches of the tail, where it grows flat. The mouth is not so large in proportion as that of the Silurus; it has no tongue, and the structure of the mouth and palate agree exactly with the description of that fish. From the edge of the nostril on each side arises a small cirrus; and from the angles of the mouth 2 others, that are stronger, and twice as long. On the lower lip are 4 more, the 2 external being the longest. The eyes are situated near the corner of the mouth, close on the edge of the upper jaw. The branchiæ are 4 on each side, and all of them have a double row of sharp points, like the teeth of a comb. It has 2 fins, situated near the branchiæ, consisting of 7 radii, to the interior part of which is joined a pretty strong prickly bone: about an inch above the anus are 2 smaller fins. A long fin extends from a little way under the anus to the tail, as another of the same kind does from the neck all along the back: neither of these fins join with the tail, which is round at the tip, and composed of about 22 feathers. It is found in the river Orontes, and in some stagnant waters near it. The markets of Aleppo are plentifully supplied with it, from the month of November till the beginning of March. The flesh is red like beef, and of a rank taste; and, though for want of better, eaten much by the people, yet is esteemed unwholesome. The name it usually goes by is semack al aswad, which signifies the black fish. Its proper name however among the natives is siloor.

The fish fig. 12,† is about 4 inches long. The head is large and flat, the body oblong and compressed. Its colour is mostly of a dark silver. The eyes are large and protuberant. From the lower jaw arise 4 cirri; the longer measure one inch, the shorter 2 thirds of an inch. From the upper jaw arise 2 longer, each measuring 2¼ inches, of a firmer texture than either those of the lower jaw, or 2 other small ones placed just by the nostrils. Between the 2 long cirri are 2 small tubuli. The whole of the cirri are of a white colour, excepting the 2 longest, which are of a darkish colour, like the upper part of the head. The

* *Silurus anguillaris.* Linn. † *Silurus cous.* Linn.

fins are 8 in number. Two by the gills, each furnished with a strong saw-like bone. Two small ones near the anus. One of 8 radii, situated half-way between the anus and the tail. One consisting of 7 radii on the back. Another fin, of a membranous and fleshy texture, arises from the middle of the back, and is continued all along to the tail. The tail is forked. It is found in the river Coic at Aleppo, where the fish in general are extremely small, in proportion to those of the same kinds found in other rivers, probably owing to the assiduity of the fishermen. It is called by the natives, zakzuk.

Fig. 13 represents a fish, which in its general form somewhat resembles the above. It is in length 3 inches. The head is rather flatter; the mouth has a more inferior situation, and is in proportion larger than that of the former fish; the eyes much smaller. The cirri, situated as in the other, are 8 in number, but much shorter those that rise from the upper jaw (being the longest) measuring only one inch; they are also flatter at their origin. They both agree in the number of their fins; neither has the saw-like bone in the fin of the back, but only in those near the gills. The fleshy fin of the back is much smaller than in the zakzuk, and rises at a much greater distance from the back fin. The colour is a pale silver marbled with grey; particularly the lower part of the fins and tail. The 2 larger cirri likewise marbled, the others white. These 2 fishes (fig. 12, 13) have no scales, and the palate and other structure of the inside of the mouth is like that of the silurus. This fish is also from the river Coic.

The fish fig. 14* has, on a slight view, so much the appearance of an eel, and, except its not being so fat, eats so like that fish, that though it is much oftener brought to the tables of the Europeans at Aleppo than any other fish found in the river Coic, it has never been suspected of being any ways different from the common eel; and yet on examination it will be found of quite another genus.

The head is long and small. The extremity of the upper jaw runs out to a narrow point, like the bill of a bird; on each side of which, a little distant from the extreme point, are 2 tubuli, or processes. As in the common eel, there are 2 fins at the gills. From the occiput, all along the ridge of the back, small prickles are placed at little distances, resembling the teeth of a saw; these terminate at the origin of a membranous fin, rising about 4 inches from the tail, and is continued, as in the eel, along the lower part of the belly to the anus, at which place are also found 2 or 3 prickles. The colour of the head and back is blackish, variegated with dark yellow spots. The lower belly white, changing gradually into a yellowish cast. The fin of the lower belly, near the anus, is yellow: the other half spotted with black. The length of the fish described was 11 inches.

* Ophidium Mastacembalus. (Gen. Zool.)

LXI. Of a Curious, Fleshy, Coral-like Substance. By Dr. John Albert Schlosser, M.D., F.R.S. With some Observations on it, by Mr. John Ellis, F.R.S.* p. 449.

Having hired some fishermen to dredge, to examine the small English coral, or corallium nostras of Ray's Synopsis, recent in the microscope; the first time they hauled in the dredge, the Dr. discovered a most extraordinary sea-production surrounding the stem of an old fucus teres: it was of a hardish, but fleshy substance, and more than an inch thick, of a light brown or ash-colour, the whole surface covered over with bright yellow shining and star-like bodies, which induced him to believe it to be an undescribed species of alcyonium. He put it immediately into a bucket of sea-water, expecting every moment that the polypes, which he thought lodged in those little stars, would extend and show themselves, like those of the alcyonium, N° 2 of Ray's Synopsis, commonly called dead man's hand, but after more than half an hour's fixed attention, the vessel lying very quiet all the time, he did not perceive the least appearance of any polypes: on which he brought them to shore in the sea-water, and then, by means of the microscope, discovered every one of those stars to be a true animal, and much more beautiful than any polype, but quite of a different structure. Every one of those stars is composed of many thin hollow radii, of a pear-shape form, from 5 to 12 or more in number, all united intimately at their smaller end: every radius appears broad at the extreme part from the centre, and a little convex in the middle of this raised broad part. When the animal is alive, there appears a small circular hole, which contracts and opens frequently. All the radii are of this structure; but their common centre, which is formed by a combination of all the small converging extremities, exhibits an opening of a circular, oval, or oblong figure, forming a kind of rising rim like a cup, which, when the animal is alive and at rest, contracts and expands itself to many different degrees, with great alertness and velocity, though sometimes it remains a great while expanded, or contracted. In all these holes, the central large one, as well as the smaller ones, which last he takes to be the mouths of the animal, he could not perceive any tentacula or claws on the outside; but by looking into them very narrowly, he saw something like very tender little fibres moving at the bottom of their insides. By comparing and examining all the various pieces he had collected of this fleshy substance, with its shining stars, he observed that the size and colour, as well as the very figure of these stars, varied greatly; but the structure of the leaf-like radii, and that of their mouths, and their motions, were perfectly the same in every one individual. Many of these bodies he found so thick and large,

* The substance here described belongs to the genus alcyonium, and is the *Alcyonium Schlosseri* of Linneus.

as to resemble the great branched madrepora coral, especially as they are generally to be met with covering and inclosing the stem and branches of this stiff, ramose fucus. Thus far Dr. Schlosser.

Mr. John Ellis adds the following:

Fig. A, pl. 16, expresses this alcyonium, surrounding the stem and branches of a fucus. I have called it alcyonium carnosum asteriscis, radiis obtusis, ornatum. Fig. B, part of a leaf of the common alga, or sea-grass, with 4 of these starry figures on it. Fig. C, one of the stars magnified. Fig. D represents the fucus, on which it grows, which I cannot find any where described. I have entitled it, in my collection of English fucuses, by the following descriptive name, fucus teres frutescens, germinibus arborum gemmas fructiferas referentibus.

I have had an opportunity lately of examining this curious, fleshy, coral-like figure in the microscope, and find that all the interstices between the stars are filled with eggs of different sizes, each adhering by one end to a very fine capillary filament. The smallest eggs are globular, and as they advance in size, they change to an oval figure; whence they assume the shape of one of the radii of the stars. In several of these stars I have observed a smaller radius, as it were, endeavouring to get into the circle; and notwithstanding their seeming connection in the centre as one animal, I believe I shall soon be able to show you, in a drawing from the microscope, that each radius is a distinct animal by itself.

LXII. Two Singular Cases of Diseased Knee-joints Successfully Treated. The first by Topical Applications; the second by Operation. By Mr. Joseph Warner, F. R. S. p. 452.

The species of tumors here meant, are those which are distinguished by the name of hydrops articuli, or the dropsy of the joint; of which Mr. W. observes, there are 2 different kinds. The one where the disease is situated in the membrana adiposa, and neighbouring parts on this side the capsular ligament. The other is that species of disease, where the fluid is contained within the capsular ligament, between the extremities of the thigh-bone, and the largest bone of the leg. The first species of tumor may be distinguished from the 2d by the touch; from the appearance of the tumor of the first kind, which is pale and uniform; from a want of fluctuation, and from the little or no pain attending it. The repeated use, for some weeks, of emollient fomentations, mercurial frictions, and gentle purges, has often been known to remove this disorder. At other times it has been found, that these applications have had little or no effect, but that the disease has given way to, and been totally removed by the use of perpetual blisters to the part affected; which should, in most instances, be continued for several weeks. At other times Mr. W. has known the Pisselæon In-

dicum, in English called the Barbadoes tar, to have so good an effect, by being applied every day to the joint for some weeks, even after every other remedy had failed, as to cure such a disorder of the kee-joint, as had hitherto been judged desperate: in which case there plainly appeared to be an enlargement of the bones, as well as a very considerable one of the integuments, and of the tendinous and ligamentous parts, but without any apparent inflammation. In this instance no extravasated fluid could be discovered; however, there was an immobility of the joint, and a considerable contraction of the hamstrings. The pain was extremely great, which the patient described as shooting through the ligaments of the joint, the knee-pan, the extremities of the thigh-bone, and those of the leg. He had a severe symptomatic fever, which had been of many weeks continuance, by which he was become greatly emaciated. The reason for Mr. W.'s giving so particular an account of the circumstances attending this fact, proceeded from his desire of recommending a trial of the same remedy, in the like cases; which, as far as he could judge from his own experience, might always be safely done where there was no degree of inflammation already formed on the integuments.

The 2d species of hydrops articuli, or that where the extravasated fluid is contained within the capsular ligament, may be distinguished from the first, from its deep situation; from the fluctuation which is felt on patting the knee on one side, while the other hand is held immoveably on the opposite side; from the degree of pain arising from the distension, which the capsular ligament suffers, in consequence of its contents; from the incapacity of bending the joint; and from the circumstance of its being attended with no general complaints of body, as well as from the sudden enlargement of the tumor; on the increase of which depends the degree of uneasiness in the part. This is very far from being the case in that kind of disease called the spina ventosa, which arises originally from the medulla and bone itself being diseased; whence proceed grievous pricking and throbbing pains, that usually come on previously to any visible enlargement of the part affected, or any discoverable quantity of fluid deposited in the joint; the difference of which symptoms resulting from the different diseases, is seen from the case which he describes, when it was judged necessary to cut more than once through the capsular ligament, in order to evacuate its contained extravasated fluid; which, contrary to the commonly received opinion of wounds of the ligaments being attended with certain destruction to the limb, should always be done under the like bad circumstances, in reasonable expectation of removing a complaint, which totally disables the patient, and too frequently terminates in the loss of the limb when neglected. And Mr. W. was the more inclined to recommend this practice, as he was convinced that this disease is out of the rac h of such applications, as are of service in other diseases of these parts,

whose situation is more superficial; that is, on this side the ligament, in which is contained the synovia.

[Then follows a detail of the case, the insertion of which in these Abridgements was deemed unnecessary, after the preceding observations, and account of the successful result of the operation of cutting through the capsular ligament.]

LXIII. Extract of a Letter from Mr. William Pye, dated Manilla, Oct. 1st, 1754, giving some Account of that Place. p. 458.

Manilla is one of the largest of the Philippine islands, and the city is much larger than Oxford; it has 2 universities in it, and is inhabited only by Spaniards. The houses are large, and built very strong; the ground-floor is stone; the walls of a prodigious thickness; all above is wood, and so contrived, that every piece of timber has a connection with each other, all over the house: they are let into one another, and joined together, that the earthquakes, which are very terrible and frequent, may not throw them down. The convents are likewise very strong and handsome. The suburbs are very extensive, and well inhabited.

In the year 1750 there was an earthquake here, which lasted 3 months, with almost continual tremblings, which at last broke out in an eruption, in a small island in the middle of a large lake, all round which the bottom is unfathomable. The third day after the commencing of the eruption, there arose 4 more small islands in the lake, all burning; and about a mile distance from one there is a continual fire, which comes out of the water, where there is no ground, for upwards of 100 fathoms deep. This happened but 4 years ago.

LXIV. An Essay on the Waters of the Holy Well at Malvern, Worcestershire. By J. Wall, M. D. p. 459.

[Reprinted in this Author's Medical Works, with some important additions relative to the chemical analysis of the Malvern-water, by his son Dr. Martin Wall, of Oxford.]

LXV. On the Case of a Man who Died of the Effects of the Fire at Eddystone Lighthouse. By Mr. Edward Spry, Surgeon at Plymouth. p. 477.

On the 4th of Dec. 1755, at 3 in the afternoon, Henry Hall, of East-stonehouse, near Plymouth, aged 94 years, of a good constitution, and extremely active for one of that age, being one of the 3 unfortunate men, who suffered by the fire of the lighthouse at Eddystone, 9 miles from Plymouth, having been greatly hurt by that accident, with much difficulty returned to his own house. Mr. S. being sent for found him in his bed, complaining of extreme pains all

over his body; especially in his left side, below the short ribs, in the breast, mouth, and throat. He said likewise, as well as he could, with a hoarse voice, scarcely to be heard, that melted lead had run down his throat into his body.

Having taken the proper care of his right leg, which was much bruised and cut on the tibia, Mr. S. examined his body, and found it all covered with livid spots and blisters; and the left side of the head and face, with the eye extremely burnt; which having washed with linen dipped in an emollient fomentation, and having applied things used in cases of burning, he then inspected his throat, the root of his tongue, and the parts contiguous, as the uvula, tonsils, &c. which were greatly scorched by the melted lead. He ordered him to drink frequently of water-gruel or some such draught; and returning to his own house, sent him the oily mixture, of which he took often 2 or 3 spoonfuls.

The next day he was much worse, all the symptoms of his case being heightened, with a weak pulse; and he could now scarcely swallow at all. The day following there was no change, except that, on account of his too great costiveness, he took 6 drs. of manna dissolved in $1\frac{1}{4}$ oz. of infusion of senna, which had no effect till the day following; when just as a clyster was going to be administered, he had a very fetid discharge by stool. That day he was better till night, when he became very feverish. The next day, having slept well the preceding night, and thrown up by coughing a little matter, he was much better. He began now to speak with less difficulty, and for 3 or 4 days to recover gradually; but then suddenly got worse; his pulse being very weak: his sides which grew worse daily from the first, now reddened a little and swelled; to which Mr. S. applied the gum-plaster. But all methods proved ineffectual, for the next day, being seized with cold sweats and spasms in the tendons, he soon expired.

Examining the body, and making an incision through the left abdomen, Mr. S. found the diaphragmatic upper mouth of the stomach greatly inflamed and ulcerated, and the tunica in the lower part of the stomach burnt; and from the great cavity of it he took out a large piece of lead of the weight of 7 oz. 5 drs. 18 grs. and of the shape of the bottom of the stomach.

It will perhaps be thought difficult to explain the manner, by which the lead entered the stomach: but the account which the deceased gave, was, that as he was endeavouring to extinguish the flames, which were at a considerable height over his head, the lead of the lantern being melted dropped down, before he was aware of it, with great force into his mouth, then lifted up and open; and that in such a quantity, as to cover not only his face, but all his clothes.

A Further Account of the Preceding Case. By Mr. Spry. p. 480.

Some persons having suspected the accuracy of Mr. S.'s statement in the pre-

ceding case, from imagining that the degree of heat in melted lead was too great to be borne in the stomach, without immediate death, or at least much more sudden than happened in this case; Mr. S. asserts the fact, not only by his own, and, if requisite, the oaths of others, but also by the following experiments, which from similarity of circumstances must not only render that probable, but in the most convincing manner the absolute possibility of his assertion.

He extracted in 3 pieces, from the stomach of a small dog, 6 drs. 1 scr. of lead, which he had poured down his throat the day before. The mucous lining of the œsophagus seemed very viscid, and the stomach much corrugated, though its internal coat was no-ways excoriated. The dog had nothing to eat or drink after; nor for 24 hours before the experiment, when, being very brisk, he killed him.

He also took from the stomach of a large dog, in several pieces, 6 oz. 2 drs. of lead, 3 days after thrown in. The pharynx and cardia of the stomach were a little inflamed and excoriated; but the œsophagus and stomach seemed in no manner affected. He gave this dog half a pint of milk just before he poured down the lead; very soon after which also he eat of it freely, as if nothing ailed him; which he daily continued to do, being very lively at the time he killed him.

From the crop of a full grown fowl, he in company with Dr. Huxham, F. R. S. extracted of lead one solid piece, weighing $2\frac{1}{4}$ oz. with 9 other small portions, weighing $\frac{1}{4}$ oz. which lead was thrown down the fowl's throat 25 hours before. The fowl was kept without meat for 24 hours, before and after the experiment, eating (being very lively just before they killed him) dry barley, as fast, and with the same ease as before. The mucus on the larynx and œsophagus was somewhat hardened. The external coat of the crop appeared in a very small degree livid; and the internal somewhat corrugated. The barley was partly in the œsophagus, though mostly in the craw, which was almost full with the lead. He took 2 oz. 1 scr. from the crop of another fowl, 3 days after the experiment, which fowl was very brisk to the last.

Allowing, for a further satisfaction, that the experiment be tried, it is requisite in making it, that the melted lead be poured into a funnel, whose spout being as large as the throat of the animal (whose neck must be kept firmly erect) will conveniently admit of, must be forced down the œsophagus, somewhat below the larynx, lest any of the lead might fall in it; and according to the quantity, either by totally, or partly obstructing the aspera arteria, cause immediate, or a lingering death; which accidents happening in his first experiments on 2 dogs, directed him to proceed in the above manner.

He had a dog with lead in his stomach, which he intended to keep, to prove how long he could live.

On the same Case of the Man, who Swallowed Melted Lead. By John Huxham, M. D., F. R. S. p. 483.

Our worthy commissioner, Fred. Rogers, Esq. sent the lead here mentioned, to Dr. H. 3 days after it was said to be taken out of the man (Hall) who was said to have swallowed it. He immediately sent for Mr. Edward Spry, an ingenious young surgeon, of Plymouth, who attended this Hall during his illness, and extracted the lead from his stomach (as was reported) when dead. Mr. Spry solemnly assured Dr. H. that he did actually take the lead, that was sent him, out of the man's stomach, and offered to make oath of it. This Hall lived 12 days after the accident happened, and swallowed several things, solid and liquid during that time; and he spoke tolerably plain, though his voice was very hoarse. And he constantly affirmed, that he had swallowed melted lead.

However, as the story seemed very extraordinary, and not a little improbable, Dr. H. did not chuse to transmit any account of it to the R. S. as he could have wished for more unexceptionable evidence; for Mr. Spry had no one with him, when he extracted the lead, but one woman, Philips, the daughter of Hall, and another woman, who were also in the house, not being able, as said, to see the operation, but immediately called in after it, and Mr. Spry showed them the lead. He sent a very sensible gentleman to inquire into this affair, and he had this account for them.

Mr. Spry was, to the best of his knowledge, a person of veracity, and he thought would not utter an untruth. But, what was more, on Wednesday he brought him a live young cock, into the crop or craw of which, he had the day before poured somewhat more than 3 oz. of melted lead. The cock indeed seemed dull, but very readily pecked and swallowed several barley-corns, that were thrown to him. He had the cock killed and opened in his view, and in the crop they found a lump of lead weighing 3 oz. and some other little bits of lead. He made no doubt the cock would have lived several days longer, if it had not been then killed. There seemed a slight eschar in the cock's mouth, occasioned by the melted lead, and the crop seemed as if parboiled. This experiment is very easily made, and seems to confirm the probability of Mr. Spry's account.

LXVI. A Further Account of the Success of some Experiments of Injecting Claret, &c. into the Abdomen, after Tapping. By Mr Christopher Warrick. p. 485.

The first case in which this experiment was tried, was that of the poor woman at Cubart, mentioned in the Transactions, N° 473, who was injected with

claret and Bristol water, and about a week after the operation died suddenly. She was upwards of 50 years of age.

The 2d instance was that of a young woman of St. Kivern, who was about 25, and had been 3 times tapped in the common way. Here they made use of 2 punctures, according to Dr. Hales's method, as recommended in the Transactions, N° 478, and claret and tar-water for the injection; which was conveyed into the abdomen through one canula, while the dropsical lymph passed off through the other. A few hours after she complained of much pain in her bowels, and on drawing off the whole contents at once, she fell into a syncope, in which she remained till about 12 o'clock the next day, when she died. It may not be amiss to mention, that her breath was immediately affected by the tar-water, and the smell of it continued to her death.

The 3d instance being somewhat singular, Mr. W. thought proper to relate it in all its particulars. March, 1752, he was called to Flushing, a small town opposite Falmouth, to attend the tapping of a poor woman, who was about 40 years of age, and laboured, as was imagined, under an ascitical dropsy, occasioned by a suppression of her menses, that happened about a year before. She had been told of his successes with Jane Roman, and desired his assistance, together with Mr. Rice, Mr. Cudlip, and Mr. Lillicrap, of the same profession. She was a married woman, of a chearful temper, had never had a child, and to all appearance was a proper subject for the operation, she being never thirsty, and her extreme parts being of the natural size: the abdomen was likewise evenly and equally distended, and of a great magnitude; but the fluctuation was not altogether so manifest as might have been expected. From these circumstances they made no difficulty to resolve on the operation, and determined to try, at the same time, the efficacy of a subastringent injection. A sufficient quantity therefore of claret and Bristol water being got ready, Mr. Rice made the puncture; but on withdrawing the perforator, instead of lymph, nothing but a thick, ropy, gelatinous fluid came through the canula, in colour resembling red port wine, or rather grumous blood. The singularity of this did not however alter their measures. Two gallons of it were immediately drawn off, and half that quantity of claret and Bristol water injected in its stead. This they proposed to have repeated the next day, and as the circumstances of the patient would admit; and to continue daily, till the whole contents should be gradually discharged; fearing that a total discharge in the ordinary way would have brought on a syncope. But when they attended her again on the day following, not one drop of any fluid came through the canula; and a 2d and a 3d puncture was attended with no better success. Soon after this, the whole abdomen became painful and distended, frequent rigors came on, and a delirium, in about 12 hours, carried her off. On opening the body the day following, not

one drop of any fluid was found in the cavity of the abdomen; an enormous cystis, which might have contained, when full, about 6 gallons, having completely filled the whole extent of it. There were likewise attached to the coats of it 5 large bodies of fungus flesh, the least of them larger than a man's fist. Each of these, when cut open, appeared to be divided into cells, full of white glutinous pus. This extraordinary mass adhered only to the fund of the uterus, and together with it, the fungus substances, and vagina, when taken out, entirely covered a middle sized pillar and claw tea-table. They now found, that in the night the canula had accidentally slipped out of the cystis; and that the operator, in making the 2d or 3d puncture, had fallen upon one of these fungous bodies, which gave occasion to the above-mentioned disappointment. On proceeding to a further examination of the abdomen and thorax, they found every thing sound, and in its proper state, excepting the posterior part of the right lobe of the lungs, which was full of purulent matter, and adhered to the pleura. Mr. W. adds, that the ovaria did not distinctly show themselves, so as to satisfy any inquiry about them; but this perhaps might be owing to the hurry or inaccuracy of the dissector.

Whether these miscarriages are sufficient to discredit a method of practice, which has the appearance of being the most rational one yet found out for managing a dropsy, Mr. W. leaves to the determination of better judges. The frequent miscarriages that happen in the ordinary way, seem sufficient to justify every attempt to render the success of it less precarious. If any further trials of it be made, he would beg leave to recommend its being done before the viscera are too much injured by the dropsical lymph; and if the evacuation be made at different times, with a view of preventing a syncope, that brandy, or some such liquor, properly diluted, be made use of instead of claret, which, as he apprehends by the heat of the body, may be apt to turn sour. It may be likewise proper that the head of the patient, during the evacuation, lies lower than any other part of the body.

As in the 2d instance above-mentioned, tar-water had been recommended by some gentlemen of the profession, then present, instead of Bristol-water, Mr. W. some time after the death of his patient, injected a pint of it warm into the belly of a small cur, to see how far the effect of it differed from that of claret and Bristol-water. The dog immediately fell into great agonies, and in about 2 hours died. The abdomen being opened, all the intestines were found greatly inflamed. He then tried claret and Bristol-water, also port wine and fountain water, on other dogs, after the same manner. Each of these injections was retained with little or no inconvenience, except intoxications: and in 48 hours the dogs became well again, the injection being entirely absorbed. It occurred to him in making these experiments, when the power of absorption seemed very

considerable, how far it might answer in preventing a syncope, or for other purposes, that a fit quantity of a properly adapted injection be left undischarged, after tapping, which might be either absorbed or drawn off at proper intervals, as the strength of the patient might admit.

LXVII. On the late Discoveries of Antiquities at Herculaneum, &c. in Two Letters from Camillo Paderni, Keeper of the Museum Herculanei. Translated from the Italian by Robert Watson, M. D., F. R. S. Letter 1st, Dated at Naples, June 28, 1755. p. 490.

In April last, a little beyond La Torre della Nunziata, where stood the ancient Pompeii, in digging near the amphitheatre, there was discovered a marble capital of the Corinthian order. On making further trials, there were found 2 pilasters of white marble, about 10 feet high, fluted on every side, with capitals and bases of the Corinthian order. On one side of these pilasters have been found a series of 9 other pilasters, about 7 feet high, equally wrought with the larger: there were likewise 5 other pilasters on the side of the other great one, making in all 16; which are all of one piece, exclusive of the capital and the base, except one, which is composed of 2 pieces. They were all excellently preserved, and were standing; forming a portico before a building. All the buildings, which are in Pompeii, are of the same constitution with those of Herculaneum and Stabiæ; that is, of one story. The portico is continued on the sides, but the pilasters are not of marble, but of brick covered with stucco, and coloured with green, and are not fluted like those of marble. One only of the sides is yet undiscovered, and we must wait to see the side opposite to the front, and the rooms within, to be able to speak decisively.

The front was all painted in the grotesque manner; but little, and that ill preserved, remains. There were no ornaments of stucco, or marble; the walls indeed were coloured, and there were some small niches formed in the walls, each of which corresponded to one of the pilasters, and consequently there were 18 in number. In several of them were found certain figures, some of earth, others of marble, in this order; first was placed one of marble, then one of earth: those of marble were 9 small Hermæ, among which there is a Hercules crowned with oak, some satyrs, fawns and Bacchantes. Two of them are of the old red, and the other of the old yellow marble, and are of an indifferent style. Those of the baked earth consist of 4 figures. The first is a Barbarian king, who stands erect with his right hand under his chin in a pensive manner, and wears his chlamys clasped with a fibula on his right shoulder. But what makes this figure the more curious is, that the whole body forms a vase, on the back of which there is a handle to hold it by. Behind the head there is a little tube, through which water or some other liquor was poured in, and the mouth

of the figure is open, through which the liquor was poured out. The height of it is about 10 inches, and the style rather low.

The 2d figure is of the same height and character, as to the workmanship; but what it represents, renders it singular. This figure seems sitting, with its legs stretched out, which are distorted like those of some dwarfs. It has a great head; the mouth, eyes, and nose, of which are extremely overcharged. It is dressed in the prætexta. On the breast is the bulla aurea, the string of which surrounds its neck, and is held with the right hand; with the left it holds the tablettes called pugillares, on which the ancients placed wax, and wrote on it with a style. These pugillares are exactly like those dug up at Herculaneum, and which are preserved in that museum. Besides, it bears a great priapus, and behind is seen the breech. This was made for a vessel, such as that described above, except that besides that the mouth of this figure is pierced, the liquor can also be poured from the priapus.

The third figure is entirely like the preceding, except in its dress, which is rustic, and bound round the waist with a cord, to which is fastened somewhat that cannot be made out, but which appears to be a little case to hold something: the rest is not overcharged, but is rustic. It holds in its right hand a loaf, and its left hand is covered with its dress, and, like the other, it shows its breech and priapus. Probably such vessels were used for drinking the liquor coming out of the priapus, this being not unusual with the ancients, as Juvenal in his second satire, gives us to understand; Vetreo bibit ille priapo.

The last figure represents the Roman Charity. She is sitting, and with her left hand embraces her father, and with her right presses the breast which her father sucks; who is expressed in this figure totally emaciated. This does not, like the others, form a vessel, but simply exhibits the story. The style is moderate, its height near the same as that of the others. This last groupe is covered with a varnish of glazing, like that which covers earthen plates and things of that kind. There were found, in the before-mentioned niches, 2 little busts of baked earth, of the same height; one wants the head. This is all that is found in that part of the building, which is supposed to be the front.

In a little closet, the dimensions of which are about 6 feet in length, and 4 in breadth, discovered the 13th of last month, was found a very fine tripod, about 3 feet high, extremely well preserved. In short, it is one of the most beautiful pieces of antiquity in the whole world. It is formed of 3 satyrs, young, and all exactly alike. Their heads are most beautiful, with a cheerful countenance, and the hair well disposed with a ribband, that surrounds the head. On the forehead stand 2 small horns, which are united. The right hand rests on the side of the body, and the left is open, with the arm somewhat extended. They have a great

satyresque priapus. The legs are united, and they place their feet on round bases, which have been turned in a lathe, and then covered with leaf silver. Their tails are twisted round a ring, by which they are suspended. The 3 satyrs support with their heads the hearth of the tripod, which is of excellent workmanship, and has 3 moveable rings, which serve to remove the tripod from one place to another. One of these rings is wanting, and could not possibly be found. Whence we may suppose, that originally it was likewise wanting. On the hearth is another ornament united to its circumference, and forming a kind of radiated crown, which crown has also 2 handles, but not moveable. These serve to place the crown on the hearth. The bottom of the hearth is not of brass, like the rest of the tripod, but of baked earth. The above-mentioned closet, where this tripod was found, is all painted, and entire, with the ceiling unhurt. In the walls of it was a table of white marble, fastened in the wall itself, which might be called a side-board, and which was extended along the sweep of the room. On this table was found a crescent of silver, about 5 inches in diameter, and on the edge of its middle are 2 small holes to receive a string to support it. Perhaps this was an amulet, for we have another of the same metal, but smaller, with its supporter of silver, which has been long found. On the same table was another amulet of silver, about an inch in height, which represents Harpocrates. This figure has its finger near its mouth, the lotus on its head, and wings on its shoulders. On the right shoulder hangs a quiver, and its left arm holds a horn of plenty, and leans on the trunk of a tree, round which is a serpent, and at the foot of the trunk stands an owl. There was found a kind of fibula, which is of gold, and is extremely well preserved. Its form is round, and made like a large button. On the back there is a gold wire fastened to one side; the other end of which is fastened in a small piece of gold, soldered into the fibula. The whole is little more than an inch in diameter. There were found also 2 other figures; one is of marble, about a foot high, representing a woman; it is of no great value; the other is of ivory, but there remains nothing but the name, and a part of the face, by which may be perceived, that it is the work of an excellent Greek hand. All the rest consists as it were of minute leaves, which are so brittle that they cannot be united. Its height is about a foot.

There was also found in the same closet, on the same marble table, one of the most beautiful statues ever seen, and so admirable, that I know not how to begin to describe it. Its height is little more than 3 inches, by which you may conceive what pains have been taken with it. It stands on its feet, and is quite naked, and presents a priapus, which is not satyresque, with a most perfect contrast of attitude. One observes through the whole figure a most perfect skill in anatomy, where the smallest muscle is not lost, and at the same time it seems

not dry or hard, but palpable flesh. It is of a noble and excellent stile. Its head is somewhat rustic, with a goat's beard and ears. It has a laughing countenance, turning its head with much grace, and brings its first finger of the left hand to its face. It extends and raises its right arm, which terminates in a manus impudica. Our Neapolitans, and I have seen the same in our peasants about Rome, frequently wear in their hair a pin, the head of which consists of such a hand; and they say, that they wear this against an evil eye; and in Naples some of these pins are worn by children. We have found several of these small hands at Herculaneum. It is observable, that these Priapi frequently had this hand; for among the many which remain under my care, there is one with human ears, and with this hand, which together with the whole arm forms a priapus. The head of the figure is covered with a cap, which is folded down behind; and its base is low and round, and well fitted. In fine this may be called one of the most excellent curiosities. In one of the other rooms there was a fine pair of scales, in which there are some remains of the strings made of a kind of fine coral, and the strings remain in some of the rings. There were found also many vessels of earth and fragments of metal.

In the ancient Stabiæ they go on digging; but it is long since any thing of value has been found there, except that in the beginning of this month 2 small statues of brass were discovered. One represents a Venus, but of no value. The other a Panthea with a rudder, horn of plenty, lotus, modius, and sickle. It is but of ordinary workmanship. Many vases of earth, some of glass, have been found. A great vessel of copper with a handle, a singular funnel, a beautiful little vase of rock crystal with its cover, and a simpulum or ewer; divers medals, as well silver as copper, well preserved, but common, and various pieces of leaden pipes, have also been fonnd there.

The same may be said of Herculaneum; for since the month of March, after the colossal bust of brass was found, they have discovered nothing of value, except one thing, which ought to make much noise among the learned, and which I believe to be the only one of its kind in the world. This is a little leg and thigh of metal covered with silver, and which is 5 inches long. On the external part of it is described a sun-dial formed on a quadrant, and as the thigh forms a quarter of a circle, the workman has taken the centre of this quadrant from the extremity or leg of the ham or gammon, and hence has drawn hour lines, which, with the lines that mark the months, form the usual compartments, some larger and others smaller, which are divided 6 by 6, as well in height as length. Below the inferior compartments, which are the less, are read the names of the months placed in 2 lines in a retrograde order, so that the month of January is the last in the first line, which bears the other 5 following months. In the 2d line are described the 6 other months in their natural order; so that the month of De-

cember is under January, and so the months shorter and longer, 2 and 2, have one common compartment for each couple. Almost on the edge of the right side, there is the tail of the animal somewhat bent, and this performs the office of the gnomon. On the extremity of the bone, that is, of the leg, or centre of the quadrant, there is a ring to hold the dial in an equipoise; and it is supposed that in that place was fastened its plummet, such as in the like dials is to fall on the present month, to determine the shadow of the gnomon on the horary lines. It is observable also, that as these dials were described on a plain surface, according to a fixed rule, the surface of this metal ham being in one plane concave, in another convex, one cannot easily guess what rule the workman used to describe a dial of so difficult a kind, on a surface so irregular.

I must not neglect to acquaint you with what has been found in a trial made at Cuma, where were situated some sepulchres, which afforded many curious things. In May last, our miners opened a tomb of the family Pavilia, which formed a small chamber. On the floor were 3 corses, or rather their bones, which were included in 4 pieces of the piperine stone. These 4 stones formed for each corse an oblong case. The engineer, who was present at the discovery, told me, that one of these bodies was all covered by a substance unknown to him; but from his account I comprehended what it was. The corse was covered with a cloth of amianthus, which, as it was large, remained in this situation all on a heap, but calcined by the salts of the earth, for which reason it was necessary to take it up in pieces, it being become extremely brittle. However, to be more sure of my opinion, I had a mind to try it in the fire, where it remained unchanged; whence there is no doubt but that it is amianthus. There were found a great many little pieces of paste as large as beans, which were taken by the miners for comfits but are the confection, which used to be put on dead bodies. They are composed of myrrh and other spices, and even now retain a very strong smell. There was found some cloth reduced almost to nothing, which had some ornament of gold embroidered on it, or rather wove into it, as is more probable from the gold thread. On the above-mentioned body were found some pieces of paper, for I have great reason to think it such from the trials, which I have made on the old papyrus, of which we have about 800 volumes. This paper on one side is coloured with red minium, on the other it is black.

Besides this paper, there were found a mirror of metal, and 3 tesseræ, or dice. Under the corse, or bones, was found a padlock, through which were passed 3 iron strigils, and another that was broken. It is remarkable, that in all the other sepulchres, that were opened at Cuma in the month of May, there were found a mirror, 3 tesseræ, strigils, and some very small fibulæ of bone. In the above-mentioned sepulchre was found a small lectisternium, or rather pulvinar

deorum, which was very much decayed. It is mounted in iron. The ornaments which compose it being of ivory, the rust of the iron has as it were destroyed the whole. So that there were collected but a few remains of the 4 pillars, some pieces of the bands, which went round the frame, 8 pieces of ivory, of an oblong form, in each of which was engraved a figure of some unknown deity, all of the same design, but in a bad style; and two heads of a horse, which are fellows, and belong to the lectisternium, not unlike that great one of brass, which is now in the Royal Museum. There were found also several little vases of earthen ware, whose form is this: they have a long neck, with a mouth proportionably straight; the body is oval, which towards the bottom is so small, that they cannot stand upright. The misfortune is, that 2 of these vases, which are of oriental alabaster, and of the most excellent workmanship, are both broken in the middle.

Near this sepulchre there was opened another, belonging to the freed men of the Pavillia family. There we found many glasses and pieces of earthen ware, and two most beautiful earthen lamps. On one of them is a Hercules going to slay a serpent with his club, which he holds in his left hand. On the other is a priestess of Bacchus, which in one hand holds the sacrifical knife, and in the other the half of a victim. There are also 2 very small wine-glasses, which contain, the one a liquor of the colour of red wine, the other a liquor more limpid than white wine, but without any smell. In this tomb were found also the usual dice, strigils, mirrors, and fibulæ. The bones and ashes were in urns made of earth.

Four other sepulchres also have been opened, in all of which were found the usual strigils, mirrors, tesseræ and fibulæ. In one of them was found a little earthen urn with its cover. Within the same tomb was a small urn of glass elegantly made, containing the ashes of a child. Near the said urn were found several little things, which probably were the playthings of the child; these were two very small goblets of baked earth glazed, with a handle to each; two small water ewers, of the same materials, with ornaments; these also are extremely small; another vase of common earth, which forms a recumbent ox, on the back of which is a hole to receive the water, which was poured out through the mouth; and there is a handle on one side of the body. In this same sepulchre was found a monstrous priapus of red earth. This figure has wings, and is much overcharged. All these things, which I have described, are preserved by me in the Royal Museum, in a separate apartment from that in which is preserved what has been found at Herculaneum, Pompeii, and Stabiæ. I have already filled 8 chambers with antiquities; and because those are not sufficient, I shall begin to place many other things, which hitherto I have been forced to keep in confusion in other chambers, which are on the same floor. A single volume of the Papyrus

is unfolded, being that which treats of music. At length the name of the author, who was called Philodemus, is found written twice, at the end of the piece. The name is written once in a small, and a second time in a large hand, and in a good Greek character. They are now beginning to open, or rather to unroll another manuscript; but hitherto without much success; from some fragments we may collect that it treats of rhetoric.

Dr. Watson makes the following Observations on the preceding.

I think it probable, that Philodemus, the author of this treatise on music, was the Epicurean philosopher of that name, who was, as Strabo informs us, a native of Gadara in Syria. He wrote many pieces in prose and verse, and his 10th book, περι των φιλοσοφων συνταξεως, is quoted by Diogenes Laertius. Indeed his sect, time, and abode, will allow of the supposition of his writings on music being at Herculaneum at the time of its destruction. He resided at Rome, and was the acquaintance of Tully, and the preceptor of Lucius Piso the consul. We learn from Asconius Pedianus, that it is Philodemus the Epicurean, of whom Cicero speaks with that admirable mixture of praise, and invective, and excuse, in his oration against Piso; where he says, that he knew him to be a man of elegance and polite literature; that it was from him that Piso learned his philosophy; which was, that pleasure ought to be the end of all our pursuits; that indeed the philosopher did at first divide, and distinguish the sense in which that maxim was to be understood; but the young Roman perverted every thing to make it favour his inclinations and pleasures; and the Greek was too polite and well-bred to resist too obstinately a senator of Rome. He then tells us that Philodemus was highly accomplished in philosophy, as well as polite literature, which other Epicureans were apt to neglect; that he wrote verses, which were so sweet, so elegant, and so charming, that nothing could exceed them; that he was betrayed into a too hasty friendship with Piso, from which he could not disengage himself without the imputation of inconstancy, and that, rogatus, invitatus, coactus, ita multa ad istum de isto scripsit, ut omnes libidines, omnia stupra, omnia cænarum conviviorumque genera, adulteria denique ejus, delicatissimis versibus expressit.

I have met with some epigrams of Philodemus yet extant, some of which are, in my opinion, most facetious, and elegant. We might have had many more, had not Planudes, as the scholia inform us, rejected such out of his collection, as he thought too loose and voluptuous. Horace seems to have had some of these epigrams in his eye more than once, when he wrote his 2d satire of the first book; particularly where he says,

—— hanc Philodemus ait; sibi, quæ neque magno
Stet pretio, neque cunctetur, cum est jussa venire.

Is not this almost a translation of the

καὶ παρέχουσα
Παντα, καὶ αιτησαι πολλακι φειδομενη.

I will give the whole epigram, as a specimen of the style and manner of Philodemus; but must beg, that in reading the third verse you would recollect what Homer says of the girdle or cestus of Venus, that it contained all kind of delights and blandishments, love, persuasion, and desire.

Φιλοδημου επιγραμμα.

Μικκη και μελανουσα Φιλαινιον, αλλα σελινων
Ουλοτερη, κ' αμνου χρωτα τερεινοτερη,
Και κεστου φωνευσα μαγωτερα, και παρεχουσα
Παντα, και αιτησαι πολλακι φειδομενη.
Τοιαυτην στεργοιμι Φιλαινιον, αχρις αν ευρω
Αλλην, ω χρυσεη Κυπρι, τελειοτερην.*

Extract of the second Letter from Camillo Paderni, dated at Naples, July 29, 1755. p. 507.

A cameo of great excellence was found the 9th of this month. This cameo is in alto relievo. It is about an inch and a half long, and almost as much in breadth. It represents a half length of Ceres. The head is in profile, and has a noble and beautiful air. It is turned, together with the body, a little to the left. The left arm is a little raised, and holds in the hand some ears of corn. The right arm is lower, and close to the body. The right hand takes hold of part of a fine garment, or shift, with which the figure is in part covered. The head is adorned with a diadem; and the hair, which is of excellent workmanship, flows on her shoulders, tied with a single ribband, which rests on her neck. The stone, of which the head is composed, is pellucid, and the rest of the figure is cut out of a chalcedony by a Greek master; it was found at Stabiæ, where they continue to dig. In the same place were found also buried several vases of metal and glass very well preserved.

At Pompeii within these few days was found a most beautiful wine-strainer, small, but finely pierced, in a better taste than those already found, which are of brass. In this same place was dug up an ink-standish, with some of the ink, which I likewise preserved. There has been met with also an iron ax. There have been found, and they go on daily to find, many pictures. If the ancients had not dug in this place, we should have discovered many more things; for we find that they have taken away even some of the pictures.

* Since the death of the learned Dr. Watson, which happened March 2, 1756, soon after his translation of these two letters of Camillo Paderni, and his observations on the former, were read at the Royal Society, another epigram of Philodemus has been taken notice of, published at Leipsic in 1754, by the celebrated Mr. Reiske, which appears likewise to have been alluded to by Horace in the passage in part cited above from his second satire of the first book, ver. 120.—Orig.

LXVII. Of the Earthquake felt at Glasgow and Dumbarton; also of a Shower of Dust falling on a Ship between Shetland and Iceland; in a Letter from Dr. Robert Whytt, Prof. of Medicine in the Univ. of Edinburgh. p. 509.

The earthquake at Glasgow and Greenock happened in the night between the 30th and 31st of December, nearly at the same time. It was felt at Glasgow by almost every person that was awake, and out of bed, and also by some in bed, and who were not fast asleep. There were 3 successive shocks, or risings as it were of the earth. It was felt not only at Glasgow and Greenock, but also at many other places in the neighbouring country; particularly at Dumbarton.

By letters from a passenger on board a ship bound from Leith for Charles-town in South Carolina, it appears that on the night of the 23d or 24th of October last, when the weather was quite calm, a shower of dust fell on the decks, tops and sails of the ship, so that next morning they were covered thick with it. The ship at this time was between Shetland and Iceland, about 25 leagues distant from the former, and which was the nearest land. This shower was probably owing to the great eruption, which happened at mount Hecla in Iceland, in October.

LXVIII. Extract of a Letter from Mons. Bonnet, F.R.S. Dated at Geneva, Jan. 30, 1756, *concerning the Earthquake on the 14th of November,* 1755, *in Valais in Swisserland. Translated from the French.* p. 511.

Valais is thought to have been more shaken by the earthquake than our city and its neighbourhood. The earthquake felt here, happened Nov. 14, at 3 in the afternoon. It proceeded from the north, and lasted a minute. The earth opened on the mountain; and the opening was large enough to thrust one's hand in, and no bottom can be found. In another part of the mountain the earthquake opened a spring sufficient to turn 2 mills. The earth has been opened in another place. The opening is round, and no bottom can be discovered. The earth continues to shake almost every day, but these shocks are much gentler than the first.

LXIX. Extract of a Letter from Mons. Allemand, F.R.S. Translated from the French. Dated Leyden, Jan. 27, 1756. p. 512.

On the night between the 26th and 27th of the last month, December 1755, between 11 and 12 o'clock at night, there was a considerable earthquake on the frontiers of this country. It was felt at Liege, Maestricht, Nimeguen, Arnheim, and Breda. There were 3 different shocks, the last of which happened at about 4 in the morning, but without any noise or accident. I have been informed by letters from Swisserland, that several shocks were felt there, and that the salt-

springs of Bevieux have been rendered more salt. At Amersfort, in the province of Utrecht, on the 15th of this month, was felt a shock of an earthquake, which occasioned great consternation, but no damage.

LXX. Of some Fungitæ and other Curious Coralloid Fossil Bodies. By Thomas Pennant, Esq.* p. 513.

Fig. 1, pl. 16, was found in the lime-stone quarries in Coalbrooke-dale, Shropshire, the greatest magazine of coralloid fossils that I am acquainted with. The length of this elegant body is equal to that drawn, and its greatest diameter, which is near the top, is about an inch and a half. It is exactly of the form of a pear, with a small portion of stalk remaining; and its whole surface is

* Thomas Pennant, Esq. was born in Flintshire in the year 1726. His father was a gentleman of good family and independent fortune.

Mr Pennant has himself given us the chief particulars of his life in a small work which he pleasantly chose to write in the character of his own shade: it is entitled "The Literary Life of the late Thomas Pennant, Esq." In this publication he informs us that his zeal in the pursuit of Natural History was first excited by a present of Willughby's Ornithology, which was made to him by a relation, when he was about 12 years of age. In 1754 he was elected a Fellow of the Antiquarian Society, and in 1767 a F.R.S.; having distinguished himself by his ingenious and useful work the British Zoology, and other scientific publications. The British Zoology was at first undertaken for the benefit of a Welsh school, but the splendid nature of the work in its folio form seems to have operated to its disadvantage as an affair of profit, and it was never continued on a similar scale, but was republished in 4to, in which state it is too well known and esteemed to require particular description. In 1757 Mr. Pennant was, at the instance of Linnæus himself, made a member of the Royal Academy of Sciences at Upsal, and he continued to correspond with Linnæus till the age and infirmities of that illustrious naturalist obliged him to desist. In 1765 Mr. Pennant travelled into France, where he passed some time with the celebrated Count de Buffon. He went into Switzerland, where he commenced an acquaintance with Haller, and at Zurich with the Gesners, one of whom was the descendant of the famous Conrad Gesner. He then visited Holland, and at the Hague found the celebrated Dr. Pallas, with whom he ever after maintained a constant correspondence on subjects of natural history. In the midst of these his reigning pursuits he never neglected the company of convivial friends, or shunned the society of the gay world. Mr. Pennant lived some years after the publication of his Literary Life, during which time he still pursued, with as much assiduity as his increasing infirmities would permit, his usual course of study, and died at his seat at Downing in Flintshire in the year 1798. It remains to add, that Mr. Pennant's person was elegant, his manners in the highest degree polished, and what is of infinitely more importance, that his character was equally estimable.

The publications of Mr. Pennant are numerous, and are remarkable for variety of information, which is generally detailed in a very entertaining manner. His tours in Scotland, Wales, &c. are held in great esteem. His Indian Zoology contains descriptions, accompanied by plates, of a few of the rarer Indian animals, but was never continued to any farther extent. His "Outlines of the Globe," a vast work, has as yet been only published in part: of this the "Arctic Zoology" can hardly be too much commended: the parts relative to India, New-Holland, and some other regions have also appeared; and it is greatly to be wished that the whole of a work so much abounding in general as well as zoological and geographical information should at length be presented to the public.

covered with small shallow polygonal cells, the stalk excepted, which is perfectly smooth.

Fig. 2 is a small fungites from the same place, of the same size with the figure; the top is convex, and thick set with minute circular cavities; the stalk tends to a conoid form, and is coarsely striated lengthways.

Fig. 3 has a very deep cup-like cavity in it, the bottom of which is very finely radiated; the remaining part covered with small tubera, not unlike those that sometimes are seen in the insides of flints and pebbles. Externally it is irregularly cellular, but the stalk is striated.

Fig. 4 is a very singular body, and the most remarkably shaped fungites I ever saw, being exactly oval on one side, and flat on the other, without the least appearance of stalk. The oval or lower part is reticulated with polygonal cells, like fig. 1. The flat or upper part is striated semicircularly, the striæ passing from one side to the other, and then reverting.

Fig. 5 he received out of Italy, under the name of lapis subluteus Veronensis stellis majoribus. The surface is finely marked with star-like cells, which are elegantly striated from their centre; and their edges rise a little prominent. The lower part of this stone is of a conoid shape, and irregularly indented with coarse circular rugæ.

Fig. 6 was found at Coalbrooke-dale; is of a white colour, and very smooth both on the sides and top, without any appearance of striæ: but what renders this very singular, is the remarkable thinness, its greatest diameter not exceeding the 8th of an inch.

Fig. 7 was found at the top of one of the highest mountains in this county, near Caer-gwrle, in a reddish loamy soil, with various other diluvian remains.

It is of a conoid shape, but considerably incurvated; the sides are striated lengthways, and likewise circularly, but the circular striæ are much less frequent than the others. At the thicker end there appears to have been a deep cup-like cavity, the greatest part of which had by some accident been destroyed, but what remains is radiated with thin and very prominent ridges placed at equal distances from each other. On one side is a small flat fungites.

Fig. 8 is a fungites from Coalbrooke-dale, seemingly formed of 3 or 4 smaller, inserted one into the other. It has the same cavity on the top as the former, with a minute striated concha anomia in it. Fig. 9. This fungites is almost straight; has a small cup-like striated cavity on the upper end; is encompassed with prominent ridges on the sides; and is striated lengthways. Fig. 10. This species came from Piedmont, and differs from all the rest. It may be called an echinated fungites, having 6 orders of sharp-pointed studs running lengthways from top to bottom, and between each order appear some very minute longitudinal striæ. The upper part, instead of a cavity, is composed of several thin la-

mellæ rising above the sides. Fig. 11 is a Coalbrooke-dale production, and is a cluster of fungitæ, though only 2 appear in the figure. This varies from some of the foregoing in the shape of its head, in the middle of which is a shallow circular cavity, its sides rising a little prominent, and the striæ, which commence the inside, pass over the ridge, and are continued to the edges. Fig. 12 is from the same place. The cup-like cavity in this is pretty deep, and radiated with deep strigæ: and the sides are marked with very distinct ridges running lengthways, though sometimes interrupted by circular furrows.

LXXI. An Account of Inoculation, by Sir Hans Sloane, Bart. given to Mr. Ranby to be published, Anno 1736. p. 516.

Sir H. S. had heard by several reports from China and Guinea, but especially from Turkey, of the inoculation of the small-pox; and took an opportunity, when Dr. Wm. Sherrard was English consul at Smyrna, to desire the favour of him to inform him of the truth and success of it. In answer to which he told him, that the consul from Venice residing there, a physician, Dr. Pylarini, had taken particular notice of that practice, and had promised to satisfy him about it; which he did by a letter, which was printed in the Phil. Trans. in 1716, and he believed at Venice.

This notice lay dormant till Mr. Wortely Montague, (then ambassador from England at the Porte) and the Lady Mary had inoculated their son at Constantinople, and wrote about this practice, and the advantages of it, to the court and their acquaintance here, and afterwards brought into England their inoculated son, in perfect health.

The princess Anne, then princess royal of Orange, falling ill of the small-pox in such a dangerous way that her life was doubtful, the late Queen Caroline, when princess of Wales, begged the lives of 6 condemned criminals, who had not had the small-pox, in order to try the experiment of inoculation upon them. But Mr. Maitland, who had inoculated at Constantinople, declining for some reasons to perform the operation, lest it should be lost, Sir H. wrote to Dr. Terry at Enfield, who had practised physic in Turkey, to know his opinion and observations about it; who returned him this answer, that he had seen the practice there by the Greeks encouraged by their patriarchs; and that not 1 in 800 had died of the operation. On his speaking to Mr. Maitland, he undertook the operation, which succeeded in all but one, who had the matter of the small-pox put up her nose, which produced no distemper, but gave great uneasiness to the poor woman. After their recovery, in order to obviate the objection made by the enemies of this practice, that the distemper produced by it was only the chicken-pox, swine-pox, or petite verole volagere, which did not secure persons against having the true small-pox, Dr. Steagertahl, physician to the late king,

and Sir H. joined their purses to pay one of those who had it by inoculation in Newgate, who was sent to Hertford, where the disease in the natural way was epidemical and very mortal, and where this person nursed and lay in bed with one, who had it, without receiving any new infection.

To make a further trial, the late queen Caroline procured half a dozen of the charity children belonging to St. James's parish, who were inoculated, and all of them, except one (who had had the small-pox before, though she pretended not, for the sake of the reward) went through it with the symptoms of a favourable kind of that distemper.

On these trials, and several others in private families, the late queen, then princess of Wales, (who with the king always took most extraordinary, exemplary, prudent and wise care of the health and education of their children) sent for Sir H. to ask his opinion of the inoculation of the princesses. He told her royal highness, that by what appeared in the several essays, it seemed to be a method to secure people from the great dangers attending that distemper in the natural way. That the preparations by diet, and necessary precautions taken, made that practice very desirable; but that not being certain of the consequences which might happen, he would not persuade nor advise the making trials on patients of such importance to the public. The princess then asked him, if he would dissuade her from it: to which he made answer, that he would not, in a matter so likely to be of such advantage. Her reply was, that she was then resolved it should be done, and ordered him to go to the late King George the first, who had commanded him to wait upon him on that occasion. He told his majesty his opinion, that it was impossible to be certain but that raising such a commotion in the blood, there might happen dangerous accidents not foreseen: to which he replied, that such might and had happened to persons, who had lost their lives by bleeding in a pleurisy, and taking physic in any distemper, let ever so much care be taken. Sir H. told his majesty he thought this to be the same case, and the matter was concluded on, and succeeded as usual, without any danger during the operation, or the least ill symptom or disorder since.

Sir H. had been consulted with on the like occasion by many, and was of opinion, that since it is reckoned, that scarcely 1 in 1000 misses having it some time in their life, the sooner it is given them the better, notwithstanding the heat of summer, or cold of winter; the danger being greater from falling into the distemper naturally, than from the heat or cold of either.

What he had observed, which he thought material, is not to inoculate such as have any breakings out on their faces, soon after the measles, or any other occasion, by which the small-pox were likely to be invited, and come in the face in greater number, and so make the distemper more dangerous. Bleeding in plethoras, or gentle clearing of the stomach and intestines, are necessary; and ab-

stinence from any thing heating, about a week before: and nothing else needful by way of preparation; and very little physic during the course of it, unless accidents happen.

[Then follows a description of the operation of inoculation, which at that time was very rude, and consisted in making an incision into the skin of the arm about 1 inch long, and afterwards applying a dossil dipped in the variolous matter, and keeping it on for 24 hours, covered with a plaster, &c.]

Of above 200 that he had advised before the operation, and looked after during it and its consequences, but one had miscarried, a son of the duke of Bridgewater, in whose family this distemper had been fatal, where the eruption of the small-pox was desperate, notwithstanding it was perfectly safe in his sister, who had undergone the same preparations, and was inoculated the same day, and with the same matter used for her brother.

On the whole it is wonderful, he observes, that this operation, which seems so plainly for the public good, should, through dread of other distempers being inoculated with it, and other unreasonable prejudices, be stopped from procuring it. One thing he had observed, that though the persons inoculated were advanced in years, it was equally successful as in younger persons.

LXXII. Of an Extraordinary Agitation of the Water in a small Lake at Closeburn, in the Shire of Dumfries. By Sir T. Kilpatrick of Closeburn, Bart. p. 521.

About a quarter before 9 on Sunday morning, Feb. 1, 1756, we were alarmed with an unusual motion in the waters of Closeburn-loch. There was first a strong convulsion and agitation of the waters from the west side of the loch towards the middle, where they tossed and wheeled about in a strange manner. Thence proceeded 2 large currents formed like rivers, which ran with rapidity beyond all description, nearly contrary ways, one from the middle to the south-east, and the other to the north-east points of the loch. There they were stopped short, as the banks are pretty high, and obliged to turn, which occasioned a prodigious tumbling and agitation at both ends of this body of water. There was likewise a current, which rose sometimes considerably above the surface near the west side, that frequently ran with great velocity 100 yards to the southward, and returning in a moment with as great velocity the other way. In the next place, there was a tossing of the waters in the ponds, which were more or less moved as the agitations of the loch came nearer this side, or kept at a greater distance from it. These agitations and currents continued, without intermission, for about 3 or 4 hours, when they began to abate a little in their violence, though they were not quite over at sun-set. This strange phenomenon was renewed on Monday morning a little before 9, and lasted for an hour and a half; but the motion of the water was not near so violent as the day before. There was no wind all the time.

LXXIII. Letters on the Irregularities of the Tides at Chatham, Sheerness, Woolwich and Deptford, in Feb. 1756, *communicated by George Lord Anson,* F. R. S.*

Letter I. From Mr. M. Godden. Dated Chatham-yard, Feb. 23, 1756. p. 523.

Mr. G. remarks on the irregularity of the tides, having taken particular notice of them by the Lys, a French ship, having broken from her moorings 3 times in that week. The first time was on Thursday the 12th instant, at about 10 in the morning, it being then about high water, or rather ebb; so that they could not get her off that tide, but attended and hove her off the next, at about 9 at night, which was sooner than expected by an hour and a half. They then put her to another mooring, and about half past 11 the same night, she broke from them also, and came on shore near the dock, it being then a small matter ebb, so that they could not get her off that tide, but attended her the next, till half past 11 on Friday morning to do it, it then being about the time of high water, but could not; the tide being not so high by 5 or 6 feet as it was the tide before, though it should have been higher, as they were increasing. And he further took notice at the same time, that the tide was at a stand several minutes, and then flowed again near a foot in height before it ebbed, and the next tide, at half past 9 at night, they got the ship off, though they did not expect she would have floated till near 12: and again in transporting her up to her moorings, there was little or no tide ran from 10 to 12, which was about the time of high water; which they greatly wondered at, as it was quite calm. All which irregularities he imagined to be owing to the wind, having had very hard gales for most part of that week.

Letter 2, from Mr. Mic. Monasty, dated Sheerness, Feb. 23, 1756. p. 525.

The day tide on the 13th instant was very remarkable; for it ebbed no more than 2 feet and a half for 4 hours after high water, when it was observed to flow again for a few minutes; then ebbed again, but so little, that at low water, we had 7 feet water at the stern of the dock, which is 5 feet more than was ever known to be. It blew very hard in the morning on the flood, with the wind to the southward of the west, and on the ebb in the afternoon the wind abated and veered to the north-west, to which he then, in part, attributed this phenomenon, as a northerly wind forces water into this river, and always makes high tides, and a southerly wind the contrary.

* The celebrated circumnavigator; he commanded the Channel fleet in 1747, when he captured 6 French men of war and 4 East Indiamen; for which and other services he was created a peer by George II. He was afterwards appointed first Lord of the Admiralty, and admiral and commander in chief of his majesty's fleets. He died in 1762, aged 65. The interesting narrative of his voyage round the world was composed under his own inspection, not by his chaplain as was long believed, but by Mr. Benj. Robins. The title, which became extinct on the death of his lordship, has been lately revived in the person of Thomas Lord Anson of Shugborough.

Letter 3, *from Mr. Walter Taylor, dated Woolwich Yard, Feb.* 25, 1756. p. 526.

The tides the last week, and even for some days this week, have been very irregular and unusual.

Feb. 9, wind s. tides very irregular. Feb. 10 and 11, the same. The 12th, the night tide flowed about 2 feet 10 inches higher than the morning tide. The 13th, the night tide flowed about 3 feet higher than the morning tide. The 14th, 15th, 16th, 17th, the tides more regular. The 18th, the flood came in much sooner than usual, and seemed to flow gradually at first, but between 1 and 2 p. m. the tide flowed several feet, as on a sudden, and continued flowing till ¼ past 3, being some time longer than it was expected it would, and they had a high tide. The 19th, this day's flood did not hold so long by a quarter of an hour as yesterday's, and not so much water by several feet. The wind being to the westward, and a frost, greatly checked the tide. Since which, the tides have been very regular.

In a 4th letter from Deptford-yard, similar irregularities were observed.

LXXIV. And the same in the River, near London, by a Letter from Robert Dingley, Esq. F. R. S., dated London, March 8, 1756. p. 530.

LXXV. Thoughts on the Rev. Dr. Hales's New Method of Distillation, by the United Force of Air and Fire. By William Brownrigg, M. D., F. R. S. Dated Whitehaven, Dec. 3, 1755. p. 534.

In the process of distilling sea water, as described by Dr. Hales, the great increase of vapour raised by his method, above what is raised by the common method of distillation, may be attributed chiefly to the violent agitation of the water contained in the body of the still, by the motion of the air continually pressed through it. Though the air, by attracting the watry particles, may also contribute to produce this effect. It is however certain, that a simple mechanical agitation of warm water will greatly promote its evaporation, by increasing its surface, from which the vapours arise, and by putting its heated particles in a brisker motion, thus exciting between them actions and reactions, and so disposing them to fly off in elastic vapours. Of this we have instances in warm water, when simply stirred about in vessels, or poured out of one vessel into another; from which the vapours visibly arise in larger quantities, than from the same water when it is not moved by such mechanical agitation.

This excellent invention of Dr. Hales may probably be applied to other purposes, besides that which he had principally in view, viz. the distilling of sea-water with greater ease and expedition, with less fuel, and in smaller vessels, than has hitherto been practised, for the benefit of navigators. It might be of

singular use, if it could be applied in the fire-engine. The great expence of large boilers in the construction of that machine, and the vast consumption of fuel in the working of it, render its uses much less extensive than they would be, could those expences be contracted. But air cannot be applied in this engine, to increase the quantity of the elastic steam, since it would pass with the steam from the boiler into the cylinder, and prevent a vacuum from being there produced, and hinder the piston from moving in it.

A mechanical agitation of the water in the boiler of the fire-engine may however be produced by other means, so as that a larger quantity of steam may probably be raised, than can be effected in engines as commonly now constructed; by which means the expences of constructing and working those useful machines may perhaps be greatly lessened.

If, for example, the boiling water, instead of being agitated by air, as in Dr. Hales's method, was briskly stirred about by a wheel placed in the boiler of the fire-engine; it is probable, that by this means the quantity of elastic vapour raised might be considerably increased, and less fuel and a less boiler might then serve the purpose. The wheel might be turned round by the water drawn up by the engine; or might receive its motion from the beam of the engine by means of a crank; or a labourer might be employed in turning it round with the hand.

But the desired effect might, in all probability, be better produced by means of elastic steam driven briskly through the boiling water. The steam of water, as an elastic fluid, possesses many of the properties of common air. Like air, when driven briskly from the æolipile, it is observed to blow up fire; and when forcibly driven through water, will doubtless produce the same agitation, as is done by common air in Dr. Hales's experiment; and may probably have the like effect with air, in elevating a larger quantity of elastic vapours. In order to excite an agitation in the boiling water of a fire-engine, by means of elastic steam. Dr. B. then proposes various means for this end. He also shows how the steam from the boiler of such an engine may be greatly increased in its strength, by heating it, by causing some part of the pipe that conveys it from the boiler to the cylinder, to be kept red hot, by making it pass through a fire.

LXXVI. Of an Extraordinary Motion in the Waters in the Lake Ontario in North-America. From Governor Belcher's Lady; dated Elizabeth-town, New-Jersey, Oct. 22, 1755. p. 544.

I take this opportunity to acquaint you with a strange phenomenon of the lake Ontario, where general Shirley has posted himself with 2000 men, at fort Oswego. A person lately come from the camp reports, that about a fortnight

since, that lake rose and fell 5 feet and half, 3 several times, in the space of half an hour.

LXXVII. Of an Earthquake felt at the Hague, on Wednesday the 18th of Feb. 1756. By Mons. Grovestins, Master of the Horse to his R. H. the Prince of Orange. p. 544.

On Wednesday morning, 12 minutes after 8, there was a shock of an earthquake. His chair received 5 successive shakes. The sconces in the chamber were also moved. Ten or 12 minutes after, he perceived a 2d shock, but not so strong as the former. The wind was S.W. Immediately after the earthquake it turned N.E. It was also felt at Maestricht and Utrecht.

LXXVIII. Of the Same Earthquake felt in Holland, Feb. 18, 1756, In a Letter from Mons. Allemand, Professor of Natural Philosophy at Leyden, and F. R. S. p. 545.

This article contains observations similar to the preceding one, and also remarks that the earthquake was felt throughout the whole territories of the republic.

LXXIX. Of the Earthquakes felt at Brussels; in a Letter from John Pringle, M.D., F.R.S. p. 546.

By a letter, which Dr. P. received from Dr. Brady, physician to the court at Brussels, he finds they felt in that city this winter 3 several shocks of an earthquake. The first was on the 26th of December; the 2d on the day following; and the 3d on the 18th of February; being the same day it was said to be felt on our coast, between Margate and Dover; but the hour is not mentioned. All these shocks he says greatly alarmed the inhabitants; but were otherwise attended with no bad consequences. Dr. Brady adds, that he was told by a gentleman from Liege, that the men who were at work in the coal-pits, and particularly in some of the deepest near that city, had assured him, that they heard the rumbling noise preceding the shock as over their heads; while those who were above-ground heard the same kind of noise as under their feet.

LXXX. On the Sinking of a River near Pontypool in Monmouthshire. By Mr. Edward Matthews. p. 547.

The 1st day of January 1756, a poor woman, living near the mouth of the river, sent her daughter for water, a great flood appearing in the river just before, who returned in surprise with the account, that it was dry. The river is called by the name of Frooyd, running between two steep hills, or woods, but not very high; it proceeds from water from the adjacent mountains, and seems penned up

and let out precipitately, to cleanse the iron ore lying near the surface on the sides of these mountains, which greatly discolours the water, which at those times, and after heavy rains, is so rapid and violent, as to carry down prodigious quantities of large stones into another river called Avon Looyd. Mr. M. walked up the Frooyd on the bottom of the river, it being quite dry, up to the chasm, that now receives the water; it is about 20 feet wide; and when its banks are full, about 8 or 10 feet deep; but now filled up to 15 feet with stones carried in by the water. There is a lime-stone rock near the surface, about 2 feet thick, lying in large beds 2 or 3 feet square, more or less in some places, joined close in others. On one side of the river near this hole, are 3 pits sunk at the same time, the one within 10 yards, of which there was no appearance before; the other two at about 30 yards up the side of the hill, which have been observed, for many years, though nobody knew the cause of them, are now sunk some yards deeper, and some trees and shrubs, that were round the edge of the pits, with the ground on which they grew, are sunk down near the bottom. These pits at top are about 12 yards diameter, gradually narrowing to a centre, in shape of a funnel or tun-dish. Under, it is supposed, is this cavity, through which the river now runs, extending itself in one place under the river Avon Looyd, at about a mile distance, where it broke out a few days after, in several places, on the opposite side of it, where were 3 small springs. The reason for this conjecture is, these springs were observed to be always clear till a few days after the sinking of this rock, but now continue to send forth large quantities of this water, which varies in colour like the water received in at the hole.

LXXXI. On the Agitation of the Waters, Nov. 1, 1755, in Scotland and at Hamburgh. Communicated by John Pringle, M. D., F. R. S, p. 550.

About 10 o'clock of the forenoon of Nov. 1, a gentleman at Queen's-ferry, a sea-port town on the Frith of Forth, about 7 miles higher up than Leith, observed the water rise very suddenly, and return again with the same motion, which he judged to be about 12 or 18 inches perpendicular, which made the barks and boats then afloat run forwards and backwards on their ropes with great rapidity; and this continued for 3 or 4 minutes, it being then calm; but after the 2d or 3d rush of water it was always less.

The following phenomena are well vouched to have happened at Hamburgh, the 1st of November 1755. In one of the churches many persons, that were present, observed an agitation of the branched candlesticks hanging from the roof, about 1 in the afternoon. In another church, the cover of the baptistery hanging from the roof was also remarked to be agitated; and the like motions are said to have happened in other churches. Also the water in the canal through the town, and in the river Alster, was agitated the same day. It is de-

scribed first to have formed several gentle whirlpools, thence to have risen more and more impetuously: throwing about mud brought up from the bottom, and at last to have subsided with a copious white froth. The Elbe rose in some places still more violently.

LXXXII. Microscopical Observations: in a Letter from Edward Wright, Esq. dated at Paris, Dec. 26, 1755. p. 553.

It appears from the experiments of M. de Buffon and Mr. Needham, that animal and vegetable substances infused in boiling water, put into bottles completely filled, and so closely stopped that no air can enter, and even kept for some time in hot ashes, that in case there should be any latent ova of insects they may effectually be destroyed; yet it appears from the said experiments, that such substances, notwithstanding such precautions, afford microscopical animalcules of various kinds, and that sooner or later, according to the greater or less degree of exaltation in the substances. Hence they conclude, that there is a real productive force in nature, by which these animalcula are formed.

Having read the accounts of these experiments, Mr. W. was desirous to make some of the same kind, which he accordingly did, in the summer of the year 1752. Though the greatest part of the animal substances, on which he made any experiments, treated in the manner above-mentioned, yielded, sooner or later, great numbers of microscopical animalcules; yet most of the vegetable substances, whether from the coldness of the season, which was not very favourable that year, or through some fault in preparing the infusion, entirely failed, and underwent a fermentation, without ever giving the smallest signs of any thing endowed with life.

May 1, 1752, at 11 o'clock forenoon, Mr. W. made an infusion of dried millepedes, or wood-lice, such as are commonly kept in the apothecaries'-shops. These he put unbruised into a small phial, so as to make it half full; then poured on them as much boiling water as filled it neck and all, stopped it with a well masticated cork, and put it into a pocket, where it was kept in a mild degree of warmth. He let it remain till 10 o'clock the same evening, when he examined a drop of the infusion with the highest magnifier of a very good microscope made by Mr. Clarke of Edinburgh. He found the whole swarming with oblong, slender, flattish pellucid animalcules, pretty nearly of the same breadth throughout the whole length of their bodies, and without any appearance of a tail, fig. 13, pl. 16, all evidently of the same kind, though not all of the same length and dimensions, extremely vivid, and, as appeared, spontaneous in their motions, which they performed in all directions in an undulatory, vermicular way.

Observing the speedy appearance of these animalcules, he wished to know, in how short a time they might be produced; for which purpose, May 3d, he made

just such another infusion, putting it into his pocket, as before, and an hour afterwards laid a drop of it before the microscope, while it was as yet milk warm. He observed a very few of these minute bodies moving about briskly in the fluid. An hour after this more of them appeared; and before the end of the 3d hour, the infusion contained a great number of them. They continued however to increase in numbers for an hour or two afterwards, when the infusion seemed to have produced all that it was capable of.

June 3d, he made an infusion in the same way of unbruised cantharides, and in much about the same time found the whole swarming with animalcules of the same kind as those of the infusion of millepedes. These bodies, which at first appeared larger than those in semine masculino, were very soon decomposed into smaller ones, to speak according to the doctrine of Messrs. Needham and Buffon, or, as others would rather incline to express it, succeeded by smaller ones, these again by others still smaller, and so on, until in a few days, the highest magnifier of the microscope could exhibit nothing distinct to the eye. The same substances infused in rectified spirits of wine, or other spirits, showed none of these bodies; and a few drops of such liquors, or of a solution of fixed or volatile alkaline salts, poured into the infusions, instantly destroyed the animalcules.

Mr. W. declines inquiring, whether these animalcules are produced by the decomposition of the substances in which we observe them, which, according to Mons. de Buffon contain a number of living organic particles, or, according to Mr. Needham, a vegetating force in every microscopical point, capable of forming secondary combinations, microscopical plants, zoophytes, or animalcules, according to the greater or less degree of exaltation, which the several substances have attained. Or whether they proceed from ova formerly existing in the substances, and capable of enduring a great degree of heat, without being destroyed, the germs of which are sooner or later developed according to the fitness of the nidus, as is the opinion of the learned and ingenious Dr. Parsons, in his treatise on the analogy between the propagation of animals and that of vegetables; as by entering into a discussion of these different sentiments, a large volume might be written without perhaps going to the bottom of the matter. Mr. W. therefore only observes, that whichever of these opinions we embrace, thus far seems to be certain, that the earlier or later appearance of microscopical animalcules, is always in proportion to the degree of tendency to putrefaction in such substances as afford them. This is the case not only with them, but likewise with maggots in meat, which every body knows are produced from the eggs of flies. The two substances millepedes and cantharides, on which the above observations were made, are very putrescent, and the infusions of them soon stunk abominably.

Castor, though an animal substance, and seemingly very much exalted, treated in the same manner as the above-mentioned substances, viewed by the

microscope every day, and kept for several months, afforded no animalcules, nor seemed to have undergone the smallest change; which confirms what the ingenious Dr. Pringle has observed, that it is antiseptic; and adds weight to the observation made above, that the appearance of such animalcules denotes a tendency to putrefaction. Hence Mr. W. thinks that such microscopical observations, made with accuracy, might be usefully applied in the investigation of the septic and antiseptic qualities of animal and vegetable substances; since in this way the first motion of putrefaction may be discovered, before it manifests itself otherwise.

Mr. W. subjoins a few remarks concerning exaltation, which seem to deserve attention. All exaltation, he observes, appears to be a certain modification of the salts and oils of bodies: a proper degree of it favours growth and vegetation, and sustains animal life: a greater degree of it, which he calls the putrefactive exaltation, and to which all organized bodies tend more or less, decomposes all such bodies, and favours the production of microscopical animalcules, or the developement of the ova from which they may be hatched. A *still higher* degree of exaltation puts a stop to this process, as also to vegetation, and in certain circumstances even to animal life, as happens with regard to all acrid chemical preparations, &c. whether of the animal or vegetable kingdom.

Those who imagine that all salts and oils hurt the vegetating force of matter, have fallen into a great error; for whence can such a vegetating force proceed, but from a due mixture and modification of the salts and oils with the earthy principle, which every one allows to be of itself inert? It is true indeed, that a very large portion of salts or oils renders substances antiseptic, or very slow either of vegetation or putrefaction, as is well known with regard to sea-salt, a large quantity of which preserves substances from putrefaction; though, as Dr. Pringle observes, a smaller one rather forwards that process, as it does likewise vegetation. Castor, which as Mr. W. formerly observed, is antiseptic, seems to owe this quality only to a large quantity of a sluggish fetid oil, which it contains.

LXXXIII. On the Cure of a Paralytic Arm, by Electricity; by Cheney Hart, M. D. p. 558.

[This was a case of paralysis rheumatica, cured by electricity used conjointly with other remedies.]

LXXXIV. Observations made at Guadaloupe on the Brimstone-hill, in French La Souffriere, in that Island. By John And. Peyssonel, M. D. Member of the R. A. of Sciences of Paris, &c. and F. R. S. Translated by Dr. Maty. p. 564.

The island of Guadaloupe is not the only one of the American Antilles, that has volcanos and mines of brimstone; few are without them; they are found in Martinico, Dominica, St. Christopher's, St. Lucia; all which islands produce sulphur, pumice-stones, and other substances usually found in volcanos. The

mountain, on which Mr. P. made his observations, is called La Souffriere, or Brimstone-hill, because it contains ores of sulphur; and its summit constantly emits smoke, and sometimes flames. It is very high, and forms a kind of truncated cone. It rises above the chain of mountains that occupy the centre of the island, and run through all its length from north to south. This conical mountain is about 3 leagues from the sea-shore, east, west, and south, and therefore almost in the middle of the southern part of the island. In ascending, it is soon observed that the woods differ in kind; the trees are smaller, and are no more than shrubs at the top, that is, on a level with the other mountains. Here you meet with none but mountain-mangles, whose wood is crooked and bends downwards, and their bark is a true Jesuits' bark. Having arrived at the spring-head of the river of galleons, south of the brimstone-hill, at the place called the Three Springs, the waters were so hot as not to be borne. The neighbouring ground smokes, and is full of brown earth like the dross of iron. In other places the earth is red like colcothar, and even dyes the fingers; but these earths are tasteless. Near these 3 burning hot springs are some others, that are lukewarm, and some very cold. They put some eggs into the hot ones, and they were boiled in 3 minutes, and hard in 7.

Going on, about the length of 400 paces, they began to get sight of the windward, or of the eastern coast of the island. Having passed this mountain of the 3 rivers, and the valley between it and the Brimstone-hill, they began to ascend the latter, where they were obliged to help themselves with their hands, feet, elbows, and knees, and to hold by the fern, aloes, and other plants, some of which were prickly, and very troublesome. They were about an hour and a half getting up to the height of about 500 feet, when they reached the gulf, at the place whence the smoke issues. This place is at the foot of a steep bank, and may be about 25 toises in breadth: there is no grass to be seen, nothing but sulphur and calcined earth; the ground is full of crevices, which emit smoke or vapours; these cracks are deep, and you hear the sulphur boil. Its vapours rising yield very fine chemical flowers, or a pure and refined sulphur. It is chiefly found in those places where the earth lies hollow, and on the chinks or funnels you see the spirit of sulphur run down like fair water, and you breathe an intolerable smell of brimstone. The ground is loose, so that they could thrust their canes up to the head, and when drawn out they were as hot as if they had been plunged into lime when slacking. Hastening out of this dangerous situation, they continued climbing to the top of the mountain, keeping to the east, or windward. When at the summit, they discovered another gulf or funnel, that opened some years since, and emits nothing but smoke. The top of the mountain is a very uneven plain, covered with heaps of burnt and calcined earth of various sizes; the ground smokes only at the new funnel, but appears to have formerly burnt in many places: for they observed abundance of these crevices

and even gutters, and very large and deep chinks, which must have burnt in former times. In the middle of this flat is a very deep abyss, or precipice. It is said, there was once a great earthquake in this island, and that the Brimstone-hill took fire, and vomited ashes on all sides, and this mountain cleft in two; when probably this abyss or precipice opened. Perhaps the volcano having been fired by lightning, the salts of the earth joined with the sulphur produced the effect of gunpowder, and occasioned this dreadful earthquake. The mountain having split, cast forth ashes and sulphureous matters all around, and from that time no earthquake has been felt in the island. This abyss, in the middle of the flat, is behind two crags or points, that rise above the mountain, and on the north side answers to the great cleft, which goes down above a thousand feet perpendicular, and penetrates above a hundred paces into the flat, and is more than 20 feet broad; so that in this place the mountain is fairly split, from the top down to the basis of the cone.

From the top of this mountain there is a most delightful prospect. You discover below the islands of Martinique, Dominica, Marigalante, and the whole extent of Guadaloupe. Those of St. Vincent, St. Kits, and even St. Martin, are said to have been seen from the top of this mountain. Montserrat, Antigua, Nevis, Radonde, and several other islands, were very distinctly observed. The air at top is bleak and sharp, but the cold not very intense. Here the party had only time to examine the great cavern and the great cleft above it, and then withdraw to the habitation whence they came, being very weary; for in coming down they were often obliged to slide, sometimes sitting, sometimes lying on their backs, and holding by the fern. They were often almost buried by tumbling into holes. They met with abundance of nests of black devils, a kind of sea-birds, that come from the north, and hatch their young on this mountain.

Any quantity of brimstone might be fetched from this mountain, even ship-loads. It might be refined on the spot, or made up into lumps to be sold, and shipped in the ore, if necessary; but it is too cheap a commodity to be worth gathering up in a country, where the price of labour is so high from the scarcity of hands. Bright yellow brimstone with a greenish cast might be gathered round the vent-holes of the burning gulf, also large quantities of fine natural flowers, or very pure sulphur. What passes in this mountain may be called a natural analysis and distillation. The brimstone takes fire in the centre of the earth, as in chemical operations, when the mixture of spirit of nitre and oil of turpentine suddenly produces a surprizing heat and flame: in like manner an oily and sulphureous exhalation inflames and sends forth fires, which the ignorant vulgar take for shooting or falling stars. The flowers rise with the acid spirit, which being condensed by the cool air, falls down in drops. By fixing bell-glasses to the apertures of the funnels, one might collect a spirit, that rises naturally. One of them having thrust his cane too far into one of the funnels, and not being

able to pull it out again, helped himself with the blade of his sword to catch hold of it. In an instant they saw the hilt quite wet, and the water dropping off, and when he drew it out, they were surprised to find the blade extremely hot.

LXXXVI. Of the Earthquake, felt Feb. 18, 1756, *along the Coast of England, between Margate and Dover, in a Letter from Mr. Samuel Warren. Communicated by John Pringle, M. D., F. R. S.* p. 579.

This earthquake happened a little before 8 in the morning. Many persons felt it by the shaking of their beds, &c. at Margate, Deal, Dover, Sandwich, &c.

LXXXVII. On the Stones in the Country of Nassau, and the Territories of Treves and Cologn, resembling those of the Giants-Causey, in Ireland. By Abraham Trembley, F. R. S. From the French. p. 581.

These stones were in a quarry, near Weilbourg in the country of Nassau, on the declivity of a hill; it had not been dug into above 20 feet deep, and 40 long. This quarry consists of a mass of stones of an almost regular form. He could not discover at what depth these stones extended under-ground. They appeared very near the surface of the earth, where the quarry lies. And there was a pretty considerable space of ground, in which the top of the stones appeared, and where it was easy to examine the shape of their upper ends. It is very far from being the same in all of them; but when a number of them are compared with one another, we find reason to conclude, that the hexagonal form is the most common. The more regular the figure of these extremities is, the more it approaches to that of a hexagon. The two ends of every stone appeared, for the most part, to have the same shape. The sides of the stone are of the same form with the ends, and are plain. Every stone is therefore a prism of a certain number of sides. They are from 3 to 8 sides, and of all the intermediate numbers. The length of the prisms is unequal, from 2 to 5 feet long. The thickness of them is not at all more equal: it is of 9 inches and under. Many of them form a pillar by lying one upon another; all their ends and joints plain. The pillars, formed by several of those stones, are placed exactly one against the other, without having any void between them. They are in a situation almost perpendicular. On breaking these stones, their colour appears clearly to be black. It is a kind of pretty hard basaltes. It strikes fire with steel; and it appears to be very like that of the Giants Causey in Ireland.

This stone must be very common in the country of Nassau. At some leagues distant from Weilbourg, is an old castle almost entirely built of it. In going from Weilbourg to Coblentz in the electorate of Treves, he observed on the road thither, in the towns and villages through which he passed, that this basaltes was made use of in the buildings and pavements. He made the same remark in his journey from Coblentz to Cologn through Bonne. He found a

pretty large heap of it in a village 3 leagues from Bonne. In continuing his journey along the Rhine, in his way to Bonne, he saw in the river, the waters being pretty low, a rock, which stood a foot or two out of the water, which was a mass of those prisms of basaltes, the heads of which appeared; and which he concluded was the top of a natural mass of the stone. Hence he was convinced that there were quarries of it along the Rhine. In coming near Bonne, the parapet-walls along both sides of the high road, are found built of these basaltes stones. There are many of them in the old walls of the ramparts of Bonne and Cologn, and in the pavements of those cities. Some authors mention quarries of this basaltes in Upper and Lower Saxony, and in Silesia.

Those who have made observations on salts, and inquiries into stones, minerals, and metals, know how common crystallizations are in nature. A very great variety are found in searching mountains, visiting caverns, and descending into mines. There are few of the naturalists, accustomed to these researches, who shall observe the basaltes above-mentioned, but will be inclined to consider them as so many crystallizations.

LXXXVIII. Account of a Work published in Italian by Vitaliano Donati, M.D. containing, An Essay towards a Natural History of the Adriatic Sea. By Mr. Abraham Trembley, F.R.S. From the French. p. 585.

In this work, Dr. Donati examines both the earth and the sea, and even the soil under the sea, to discover their fossils and other productions. His inquiries have enabled him to determine, that there is very little difference between the bottom of the Adriatic sea and the surface of the neighbouring countries. There are at the bottom of the water, mountains, plains, valleys, and caverns, just as on the land. The soil consists of different strata placed one upon another; and for the most part parallel and correspondent to those of the rocks, islands, and neighbouring continents. They contain stones of different sorts, minerals, metals, various petrified bodies, pumice-stone, lavas formed by volcanos. Istria, Morlachia, Dalmatia, Albania, and some other adjacent countries, as well as the rocks, the islands, and the correspondent bottom of the Adriatic sea, consist of a mass of a whitish marble, of a uniform grain, and of almost an equal hardness. It is that kind of marble called by the Italians marmo di Rovigno, and known to the ancients by the name of marmor Traguriense. This vast bed of marble, in many places under both the earth and the sea, is interrupted by several other kinds of marble, and covered by a great variety of bodies. There are discovered there, for instance, gravel, sand, and earth, more or less fat.

The variety of these soils under the sea is remarkable. It is to this that Dr. Donati ascribes the varieties observed with respect to the nature and quantity of plants and animals found at the bottom of the sea. Some places are inhabited by a great number of different species of plants and animals: in others, only some

particular species are found; and lastly, there are other places, in which neither plants nor animals are to be met with. These observations not only point out the affinity and resemblance between the surface of the earth and the bottom of the sea; but may likewise contribute to discover one cause of the varieties which are observed in the distribution of the marine fossils found in the earth. Dr. Donati remarked in that vast mass of marble, which is common to the bottom of one part of the Adriatic sea, and to the neighbouring provinces towards the east, a multitude of marine bodies petrified; some of which are so united to the stony substance, that they are scarcely to be distinguished. He found in some places human bones petrified, which form one mass with a mixture of marble, red earth, and stalactites.

One of the objects, which most excited the attention of our author, was a crust, which he discovered under the water in divers places, and for a great extent. It is a composition of crustaceous and testaceous bodies and beds of polypes of different kinds, confusedly blended with earth, sand, and gravel. They are found at the depth of a foot or more, entirely petrified and reduced to marble. At less than a foot deep they approach nearer to their natural state. And at the surface of this crust, they are either dead, though extremely well preserved, or still living. This observation demonstrates, that stones or petrifactions may be formed, and actually are formed, in great quantities under the water.

It is to be remarked, that these crustaceous and testaceous bodies and beds of polypes, are every where mingled in the utmost confusion with each other: which shows a striking resemblance between the crust discovered at the bottom of the sea, and those of the marine bodies petrified, found in many parts under the earth, and especially in Italy. If these marine bodies petrified are naturally in that confusion in the sea; if they were born and die; and if they have been petrified in that state; it is highly probable, that those which are found underground in the strata in such confusion, are likewise placed naturally in the same manner under the sea, when it covers them, and not by means of extraordinary events, such as volcanos and earthquakes, as has been conjectured.

The more these bodies and beds of polypes multiply, the more their exuviæ and skeletons contribute to enlarge this crust discovered at the bottom of the sea. Dr. Donati remarked, that in several parts it formed very considerable banks, and of a very great thickness. Hence it follows that the bottom of the sea is constantly rising higher and higher. Divers other causes contribute to it. Snow and rain-waters bring down from the neighbouring mountains, into the sea, a great quantity of earth and stones. The waves, beating against the shores of the continent and islands, detach many masses, which are spread upon the bottom of the sea. The rivers carry the mud with their waters into the sea, at the bottom of which that mud deposits itself. From the rising of the bottom of the

sea, that of the level of the water naturally follows. Dr. Donati furnishes us with a great number of facts in proof of this. He observed, that at Venice, in Istria, and in Dalmatia, the level of the waters is several feet higher than it was formerly. This elevation of the waters is observed only on the northern and eastern coasts of the Adriatic. The sea seems on the contrary, to abandon the western coast, that of Italy. This Dr. Donati has showed by many very interesting facts.

He proceeds then to the observations, which he made upon the plants and animals of the Adriatic sea. He begins with some general reflections on the nature of both. On this occasion he treats of the question concerning the resemblance between plants and animals, and in general of the chain, which these different organised bodies form by the affinity between them established by nature. In mentioning the facts, which show this imperceptible transition from the class of animals to that of plants, he seems inclined to believe, that these facts are most frequently to be met with in the waters.

After having given a description of several very curious marine plants, he proceeds to the beds of polypes. He gives this name to all those organized bodies, known under the name of coralline bodies; and which were, for a long time, ranged under the class of plants. He then mentions different bodies, which he calls plant-animals, and animal-plants, according to the characters which he found belonging to them, and which bring them more or less near to one or other of these general classes.

LXXXIX. On a Parthian Coin, with Characters on the Reverse resembling those of the Palmyrenes. By the Rev. John Swinton, M. A. of Christ-Church, Oxon, F. R. S. p. 593.

Some years before, Mr. S. met with a small brass medal, in but indifferent conservation; which he discovered, he thinks, by comparing it with others, to be a Parthian coin. This medal, he apprehends, exhibits the head of Vologeses the 3d, adorned with a beard and a tiara, after the Parthian manner, with a beta behind it, which seems to point out the place in which it was struck. The reverse presents a strange sort of instrument or machine, which perhaps may be imagined to represent a key, besides some traces of characters in a great measure defaced, and which he thinks are 4 entire Palmyrene letters.

XC. A Catalogue of the Fifty Plants from Chelsea Garden, presented to the Royal Society, by the Company of Apothecaries, for the Year 1755, pursuant to the Direction of Sir Hans Sloane, Baronet, by John Wilmer, M. D., &c. p. 607.

This is the 34th annual presentation of this kind, completing to the number of 1700 different plants.

XCI. On the Earthquakes felt at Turin, Dec. 9, 1755, and March 8, 1756. By Dr. Vital. Donati, Prof. of Botany at Turin. From the Italian. p. 612.

The cause of earthquakes is unknown to me. The ancients have observed, that earthquakes were accompanied with some particular meteor, and some remarkable alteration in the air. Such alterations have been observed at the time of the late earthquakes. Who knows, whether an electrical force be not capable of moving more than a quarter of our globe? I have communicated this notion to father Beccaria, and I found him almost entirely convinced of it.

On the 9th of December, at half an hour after 2 in the afternoon, a shock of an earthquake was felt here at Turin; but not a considerable one, so that a great number of persons did not perceive it. For my own part I felt it very sensibly, being then in the University-pulpit raised very high. The chair, on which I sat, was thrown by the shock from one side of the pulpit to the other, in the direction of south to north. This shock lasted between 4 and 6 seconds. Some minutes after came another shock, but it was extremely slight. Its direction was likewise from south to north. I have been informed from Milan, that about the same hour, and on the same day, a shock of an earthquake had been felt. The waters did not rise, and yet a good deal of motion was observed in those of the lakes. For 3 days the waters rose from underground in the lower apartments of the houses situated near the east gate. The springs that water the lands in the country, became more copious.

On the 28th of December at 6 o'clock, according to the Italian way of reckoning, a slight earthquake was felt at Padua.

On the 8th of March, at half after 11 in the morning, in the French way of reckoning, I felt 2 shocks directed from above downwards, but they were very slight.

CII. Of a Continued Succession of Earthquakes at Brigue in Valais. Written by the Rector of the College of Jesuits at Brigue. From the Latin. p. 616.

Valais, and especially Brigue, have almost every 10 years felt earthquakes, but never any so considerable as in 1755. For in that year, on the 1st of November, which was so fatal to Portugal, we felt Brigue several times shaken, and particularly on that very day. And from that time, especially in the night, the walls were perceived by many persons to tremble; whence they justly apprehended still greater shocks of an earthquake. On the 9th of December, about 2 in the afternoon, the earth at first made a great noise, and seemed, as it were, to give a signal for immediately retiring. This was, not long after, followed by repeated, but slight motions. At a quarter after 2, the earth was again shaken, and a much louder noise heard: at last, a little before half an hour after 2, all Valais seemed on the point of destruction; for the earth began not only to tremble, but to send forth a horrible noise, and to shake all the buildings with so violent a motion in the space of 2 pater nosters, that the houses inclined

on each side alternately, and rocked like a cradle: almost all the chimnies were thrown down; all the churches suffered very great damage; the towers gaped; a considerable number of walls fell down; and stones of all sizes poured down from all the buildings, so that no house at Brigue escaped some injury.

The whole neighbourhood suffered the same calamity, especially Glisa and Natria. In the latter, the roof of the parish church fell at the same moment; and at Glisa, the large church, and especially the tower, were greatly damaged. For a great part of the wall of the tower being removed out of its place, fell on the roof of the church, and broke it, and demolished the side altar under it. At Brigue both the church and college of the jesuits suffered very considerably. Part of the roof of the former fell down; and all the walls of the college were much cracked. In some places the earth opened and immediately closed again; and water rose from the ground several feet high. Some fountains also ceased running; and not a few, never seen before, have flowed from that time.

From the 9th of December to the 21st, the shocks were repeated every day, but still fewer and less violent. On the 21st, at 4 in the morning, Brigue was so much shaken, that every body was justly frightened: but no damage was done, except the falling down of some stones. From the 21st to the 27th, we felt the earth moved twice or thrice every day at different times. On the 27th, at half after 2 in the afternoon, Brigue suffered a shock almost equal to that on the 9th, but of a shorter duration, and attended with scarcely any damage. On the 28th, about 6, A. M. there were 2 slighter motions. The 29th was the first day free from disturbance. On the 30th, at one in the night, the houses were greatly shaken, so that some chimnies, which had been before damaged, now fell.

On the 2d of January, 1756, at half after 9 at night, there was a slight shock. On the 3d, a little before 10 in the morning, there was another gentle one; but none till the 6th, before 8 at night, when a pretty considerable shock happened. On the 7th, about 5 in the evening, were two more, as also on the 8th at half after 8 at night. For the 3 following days all things were quiet. On the 11th, at 3 in the morning, and again about 8, and on the 12th and 13th were some few shocks, but slight. On the 14th, at half an hour after 2 in the morning, every thing was put into such an agitation, as is inexpressible; but the damage was but small, as the motion lasted but 3 or 4 seconds. On the 15th, at half an hour after 5 in the morning, there was a slight shock. It is observable, that on this day, and generally for 3 or 4 hours before the earthquake, we observed a gentle trembling to precede, and the winds which were before violent, to subside of a sudden: and that the motion seemed always to be propagated from the south to the north. It is fact, that all the books in our library, though of a square form, were all thrown down from the south towards the north. I observed the same in the chasms of the ground, which were nearly parallel with the meridian. I often remarked likewise, that the Rhone grew turbid

a little before the earthquakes; and I frequently took notice, in the evening after sun-set, very long clouds stretched out like a straight line, without any breadth, and extended from the south to the north. The earth in some places was broken into fissures, but not large ones.

The writer then goes on to state, that repeated shocks were felt, but gradually less violent, from the 18th of January till the end of the month; that on the 6th and 18th of February violent shocks were experienced, with slight intermediate ones; and that they were repeated slightly till the 26th, when they ceased.

CIII. Extract of a Letter of Mons. la Condamine, F. R. S. to Dr. Maty, F. R. S. Translated from the French. Dated Rome, March 11, 1756. p. 622.

The Abbé Barthelemi, who is here, has been at Naples. In the manner of going on with the manuscripts there, it will require above a century to open and paste them all. However it is done with great dexterity. But there is only one person employed in it. The Canonico Mazzocchi, who copies them, is very capable of that task. An academy of antiquaries is just founded at Naples, for explaining all the antiquities dug up at Herculaneum; but according to their method of discussing things in their assemblies, they will not explain 2 dozen antiquities in a year. They will alter their method, and find, that such kinds of works, and perhaps all others, are not to be done by a company. The Abbè Barthelemi has read very well a page, except a few words, which he had not time to study. The account of the manuscript on music is true.

The measures of the Abbé de la Caille, and those of Father Maire and Father Boscovich do not agree with the elliptical curve of the meridian, or with the circularity of the parallels. And the earthquakes felt on the same day on all the coasts of Europe, and in Africa and America, at Ancona, Morocco, Boston, and in the Baltic, may contribute to convince those who should doubt of it, that the earth has immense cavities, and that it is very heterogeneous, or rather of a very unequal density. Consequently its figure is a little irregular; or, if the curvature be such as the laws of statics seem to require in the hypothesis of homogeneity, that figure must be altered by changes happening in the internal parts of the mass. It was at first supposed to be spherical, and the orbits of the planets were considered as circular. It was afterwards found that they were elliptical, and the earth an elliptoid. Every step made in the study of natural philosophy has discovered some apparent irregularity, according to our manner of conception. The refractions, the aberration of light, the nutation of the earth's axis have all been reduced to a calculation. Afterwards was found out the irregularity of the refractions on small eminences, which perplex astronomers. The heterogeneity of our globe will puzzle the mathematicians; and earthquakes will perhaps do so more than all the rest. I have probably observed to you before, that I am convineed, that Italy was a chain of volcanos, of which

we know only some of the links. I have found lavas exactly like that of Vesuvius in the whole way from Florence to Naples, and in places where there was no suspicion of volcanos. All the lakes of Italy, which I have seen hitherto, exhibit traces, not to say evidences, of this.

I begin to think that the whole earth is perhaps in the same case with its surface, and was thrown into the utmost disorder at some period of time, of which no remembrance has been preserved. Lazzaro Moro, a Venetian, has gone much further than I do: all the mountains, isles, and continents arose, according to him, from the bottom of the sea, by means of subterraneous fires. I never heard of his opinion till after I had formed my own conjecture, or rather verified the fact in part of the Apennine which I have passed through. I have had time only to run over the titles of his chapters.

CIV. On the Currents of Sea at the Antilles. By Dr. Peyssonnel, F.R.S. p. 624.

The coasts of these American islands are subject to counter-tides, or extraordinary currents, which render it very dangerous to chaloupes and other small craft to land; while at the same time the boats and ships in the roads are scarcely ever sensible of them, and seldom incommoded by them; nor do those which are out at sea appear to be affected by them. It is however certain that a regular wind constantly blows, in these parts of the torrid zone, from the tropic of Cancer, to the equinoctial line, from the east; inclining sometimes northward, and sometimes southward. This wind is called alizé, or trade-wind, for reasons admitted by philosophers, and it draws the water westward, giving a total and uniform course to that immense quantity, which comes from the great river of the Amazons, and from an infinite number of other rivers, which discharge themselves into the ocean. These currents passing to the westward, go up to the American islands, then to the coasts of Jucatan and Mexico, and running round in the gulf, return into the great ocean, by the straits of Bahama, along the coasts of Florida, in order to pursue, in the north, the course ordained them by the Supreme Being. It is in this course the waters are known to run with an extraordinary rapidity; they pass between the great and little islands of America, in the great deeps, by an almost even and imperceptible motion; but against the shores and coasts of these islands, which form this archipelago, these currents are very sensible and dangerous; they interrupt the navigation, insomuch that it is scarcely possible to stem these tides to get to the eastward.

It often happens, that vessels steering from St. Domingo, or the other Leeward islands, to the windward ones, cannot absolutely accomplish it, and are therefore obliged to get out of the channel, and steer away to the northward, in order to tack up to the windward isles. These are daily observations, and well known to all navigators of America.

Besides these regular currents, there are others, called counter-tides, which

are observable on the sea-coasts and shores. In places where these flow, the sea rises in an extraordinary manner, becoming very furious without any apparent cause, and without being moved by any wind; the waves rise and open very high, and break against the shore, with such violence, that it is impossible for vessels to land. These he thinks are chiefly caused by the pressure of heavy black clouds sometimes seen hanging over an island or the sea. As to other currents in the main seas, or in other particular situations, as the gut and the coasts of the Mediterranean, Dr. P. ascribes them to the action of the winds, &c.

Hurricanes are foreseen by a calm, and a frequent shifting of breezes from all points; the setting sun of a blood-red; little clouds moving with great rapidity; the sea-birds, called frigates, and many other kinds, quit the air, and seek the shore. By these signs, together with the season in which these happen the hurricanes are expected; proper precautions are then taken to avoid the fury of the winds; the houses are propped, the windows and doors are barred up, and papers and other valuable moveables are secured in chests. Soon after, a north breeze springs up, which comes to the north-east, and from south to south-east; the air is darkened by one continued thick cloud, which increases the horrors of the night; for it often happens, that these tempests come in the night, and continue all the next day. In the last hurricane he saw, the wind stood at north-east, and blew with such violence, that the largest trees were torn up by the roots, their trunks broken to pieces, and not a leaf left on those other trees which yielded to the fury of the winds; the houses were thrown down, and the tops of the sugar-mills, which are conical, and less susceptible of being thrown down, were crushed to pieces; scarcely any thing remained standing on the ground. These furious winds were accompanied with a violent rain, which resembled the mist made by the agitation of waves, or like waters kept up by the wind. The tempest lasts till day-light, and sometimes continues pretty far in the day. In that in 1740, towards 8 o'clock in the morning, it grew suddenly calm for a quarter of an hour, and then returned again blowing from the south, with such violence, that the buildings and trees, which were destroyed by the north wind before, were blown about, and moved by the first blast of that from the south. At the end of these there appears lightning, and we hear the noise of thunder: these are the signs of the tempest's being at an end; for the wind softens gradually, and all becomes quiet.

After these hurricanes the forests appeared only like a parcel of ship-masts or poles standing; all the trees being stripped of their leaves, and their branches broken off made a dreadful appearance, especially in these countries, where a perpetual verdure adorns the trees and fields. Every one is employed in repairing his losses, and mending the dismal remains of the frightful wreck.

XCV. Of the Lacerta (Crocodilus) ventre marsupio donato, faucibus Merganseris rostrum æmulantibus. By Mr. George Edwards.* p. 639.

What is most extraordinary in this species, and distinguishes it from all other crocodiles, is the narrowness of the beak or chaps, which appears like the bill of the bird called a goosander (merganser). It has small sharp teeth, of which he says no more, as he has given 3 very exact views of the head and beak; see fig. 14, pl. 16. Another particularity is a pouch or open purse in the middle of the under side of the belly, which seems to be naturally formed, with round lips and a hollow within, perhaps to receive its young in times of danger; as we find it in the American opossum. The opinion of Dr. Parsons too was, that the opening in the belly was really natural, it having no appearance of having been cut or torn open. In other respects it has all the marks common to alligators and crocodiles, viz. a particular strong square scaliness on the back, which in the young ones appear distinct and regular, but in the older ones lose their distinct form, and become knobbed and rough, like *the bark of an old tree;* and in having small, round, and oval scales on their sides, which in the young ones are no larger than rape seeds; and the belly is scaled, to appearance a little like the laying of bricks in a building. It has fins on the outsides of its fore and hinder legs, as other crocodiles have. It has also a great distinguishing mark of the crocodile kind, viz. two rows of fins on the upperside of the tail, which begin insensibly small at the setting on of the tail, and increase gradually as they advance toward the middle of it, where they become one row, and so continue to the end. The tail is roundish at its beginning, but from the middle, where the two rows of fins become one, it is flat like an oar. The fore feet have each 5 toes, the hinder feet only 4; which is also a mark of the crocodile; all the lesser lizards having 5 toes on each of their hinder feet. In the fore and hinder feet, the 3d and 4th toes only are webbed together. The eyes are very prominent. The head is covered with several large scales. The beak is *finely creased* transversely. As I have been very exact, says Mr. E. in my figure, which was worked on the copper-plate immediately from nature by my own hand, and in several different views, it will express more than can easily be conveyed by words. It appeared in the spirits all over of a yellowish olive colour, the underside lighter than the upper; the upperside having some dusky marks and spots, as represented in the print. This species Mr. E. believes, when at full growth, to be near, if not quite, as large as the common crocodile.

* This species is the *lacerta gangetica,* Linn. Gmel. It grows to a larger size than the Nilotic crocodile, and exclusive of the long and narrow form of the snout, it has nearly double the number of teeth: the specimen here described was so young as to have the opening of the umbilical vessels still remaining: otherwise it has no particular ventral cavity, as erroneously imagined by the author.

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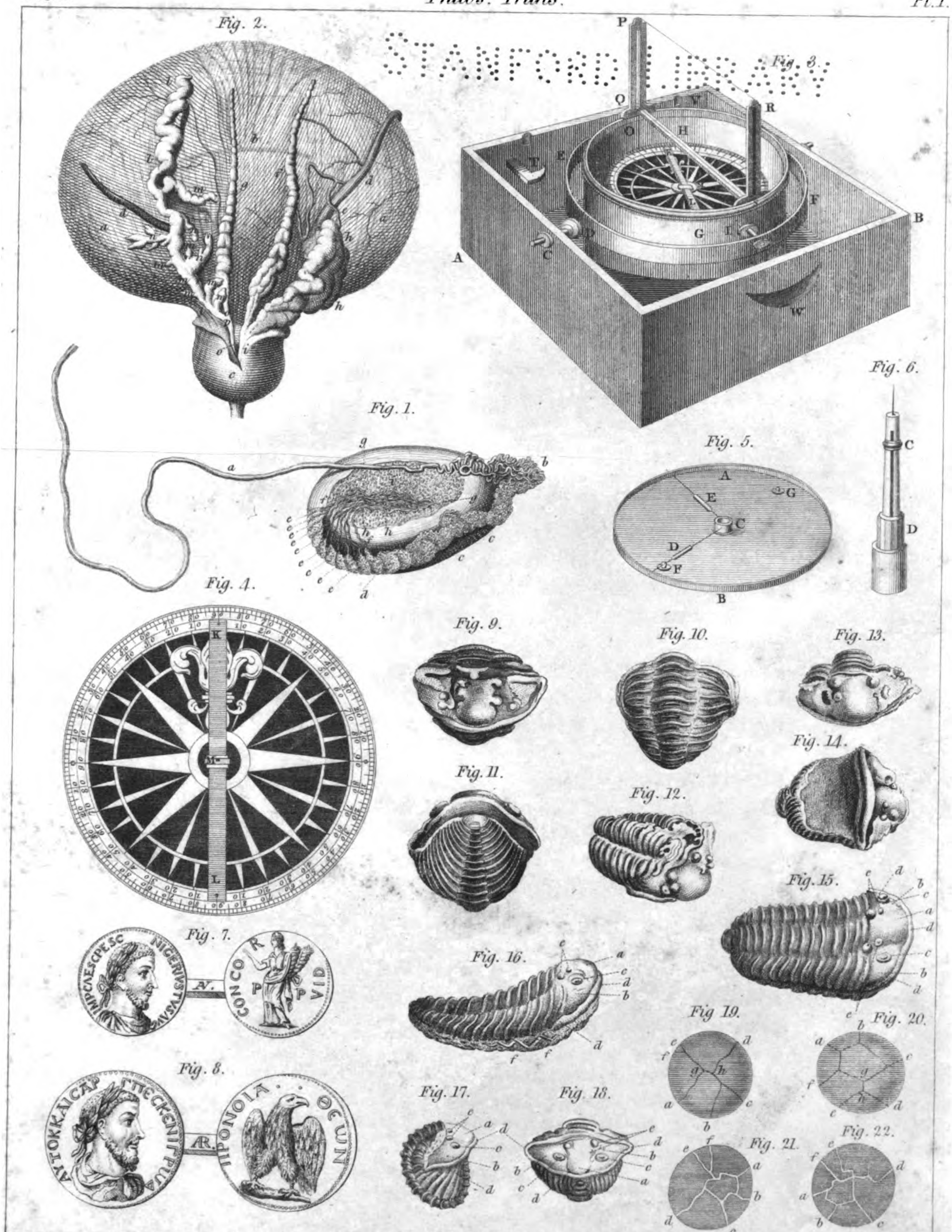

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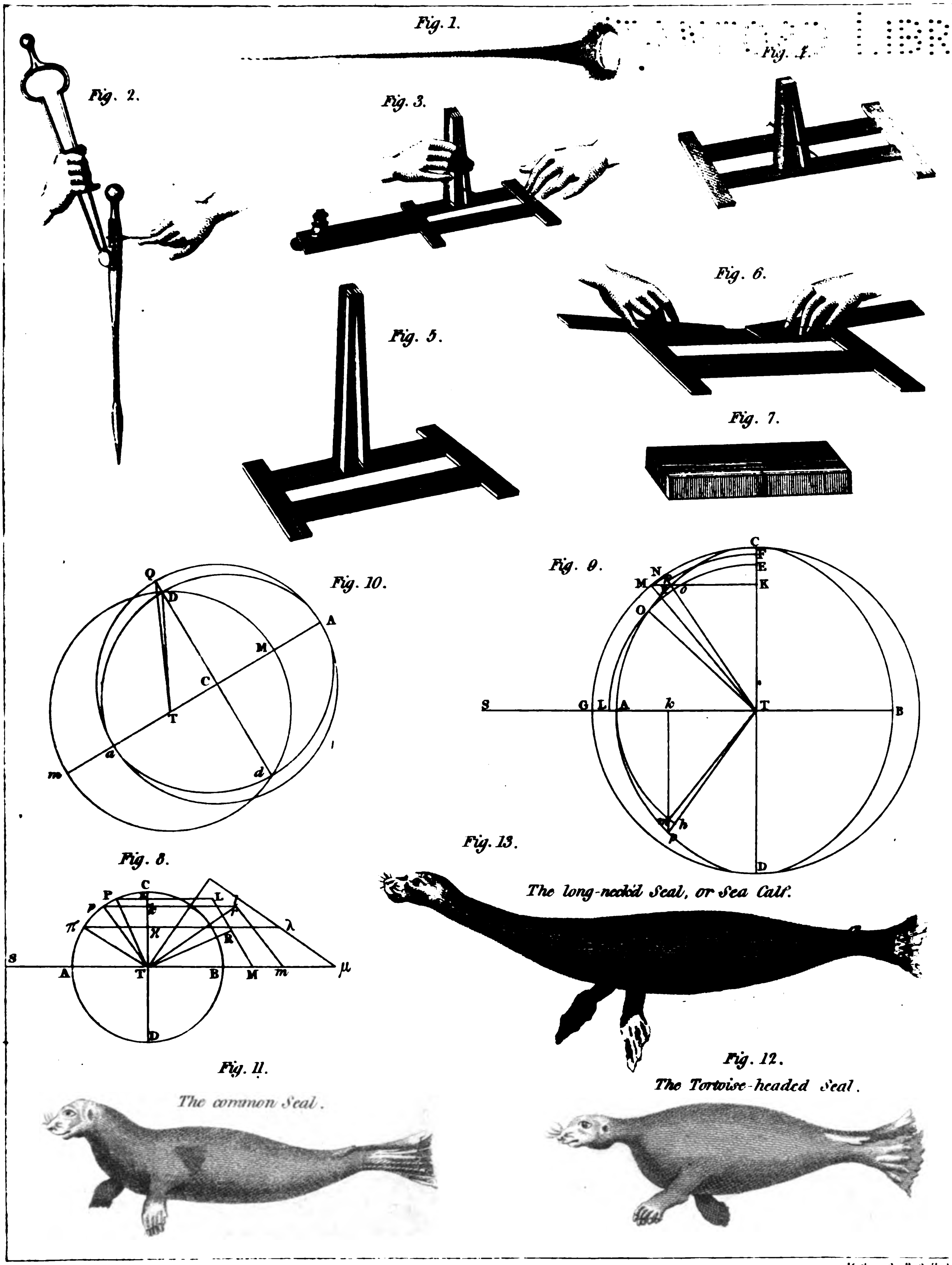

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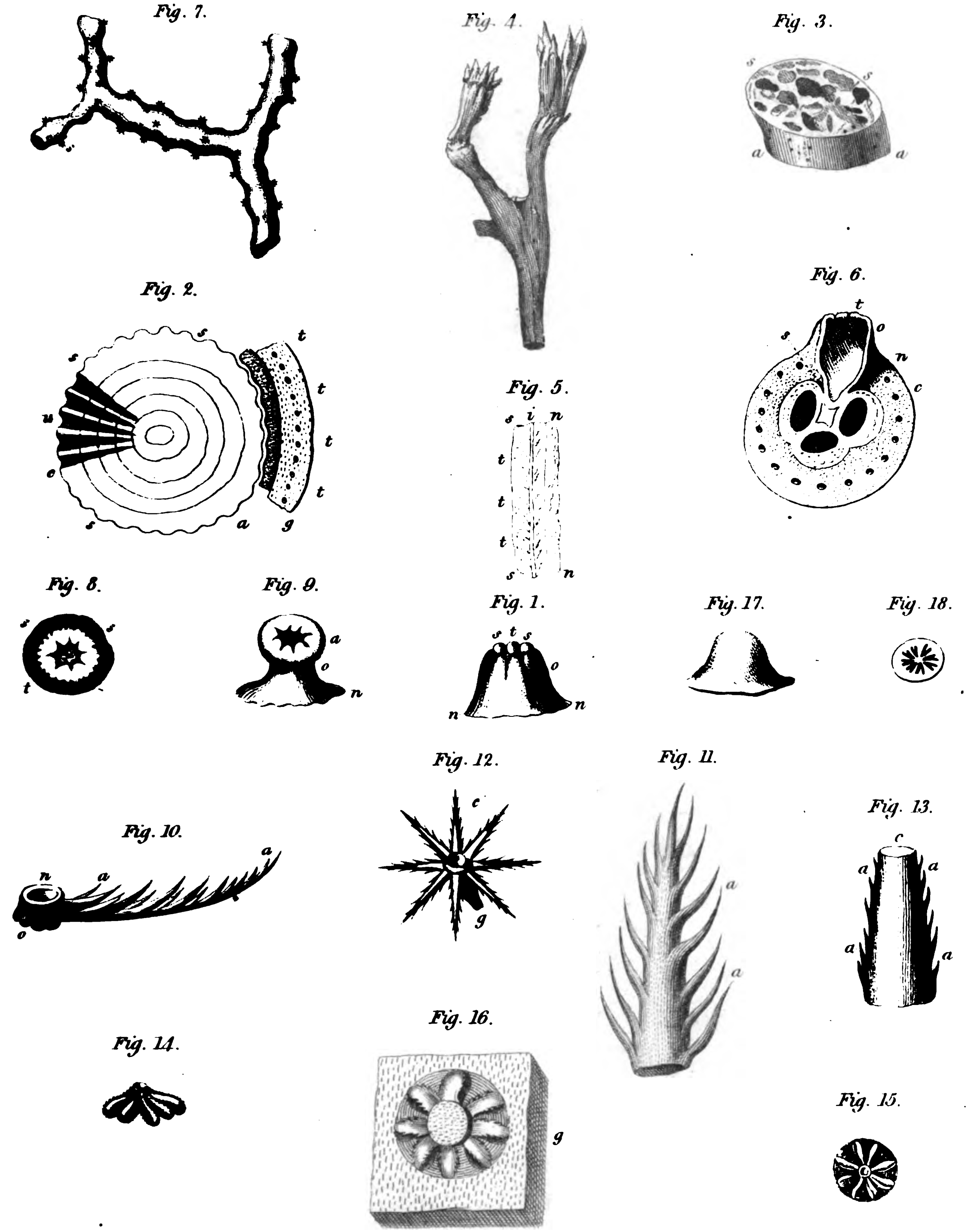

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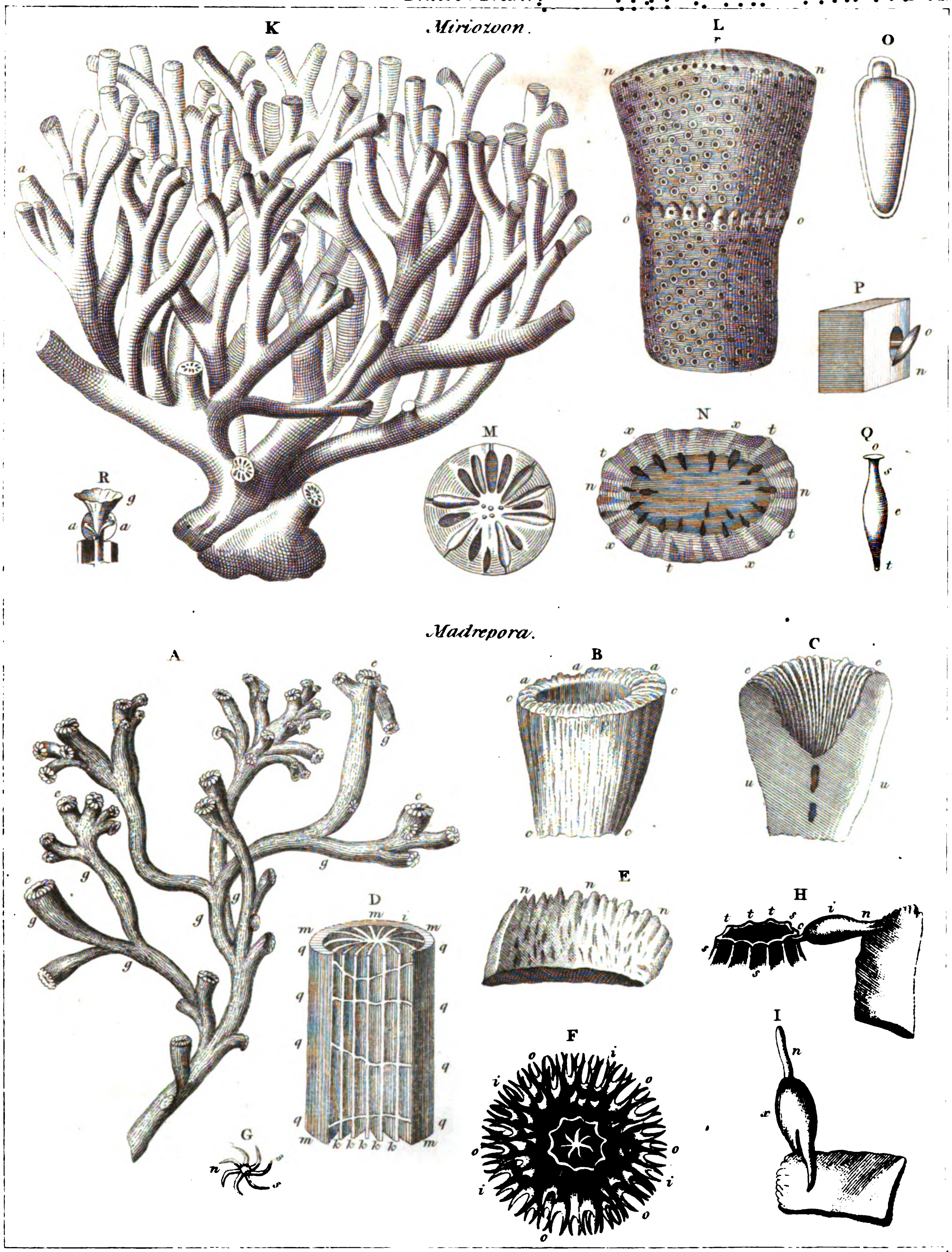

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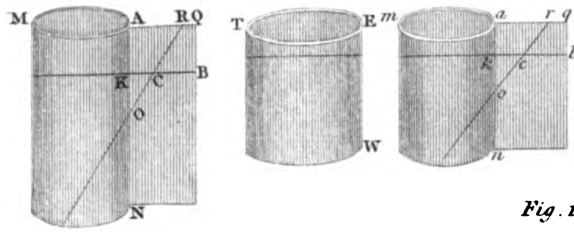

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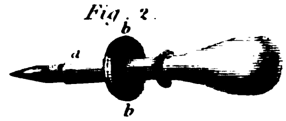

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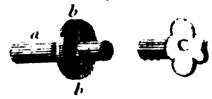

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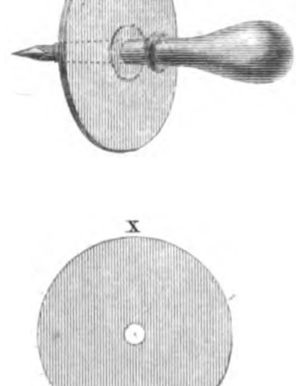

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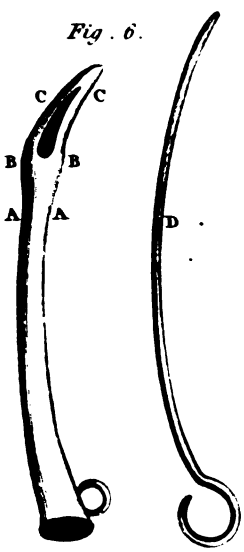

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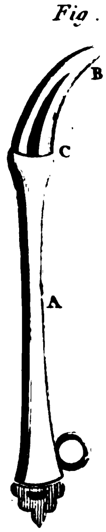

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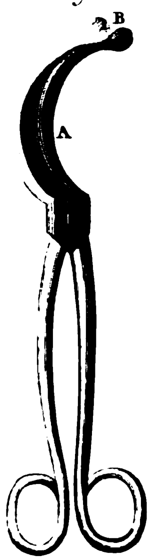

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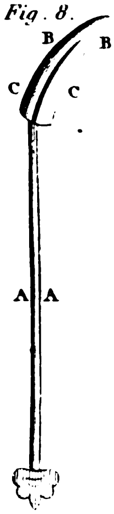

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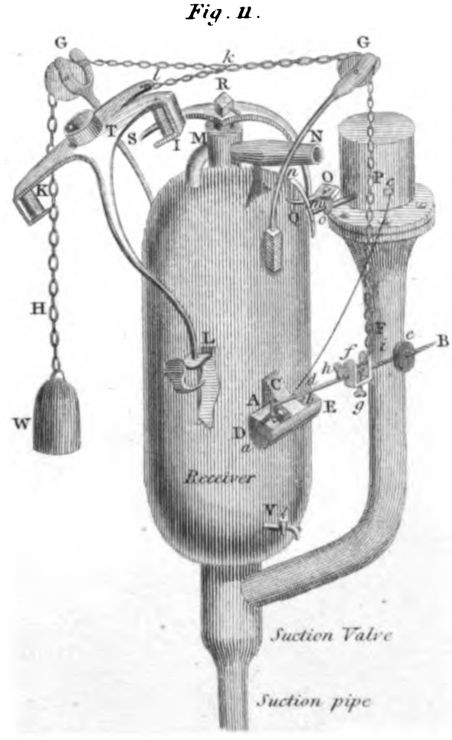

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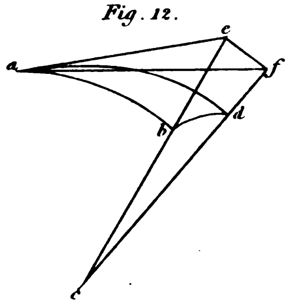

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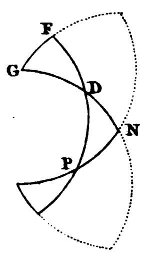

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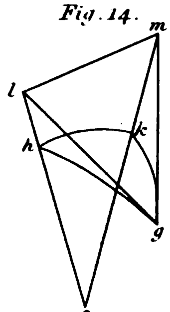

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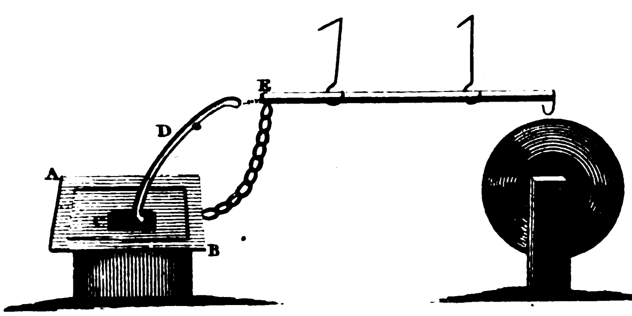

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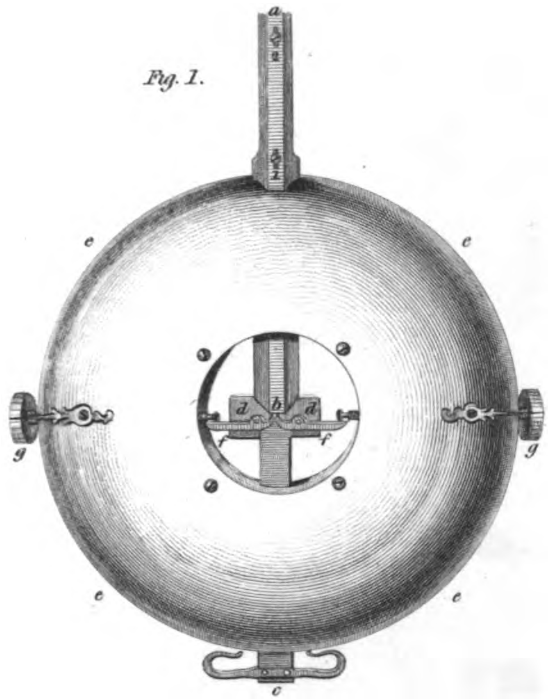

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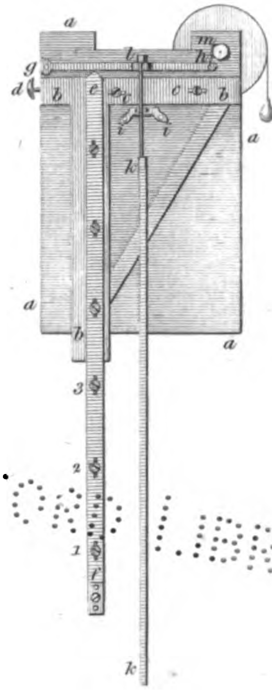

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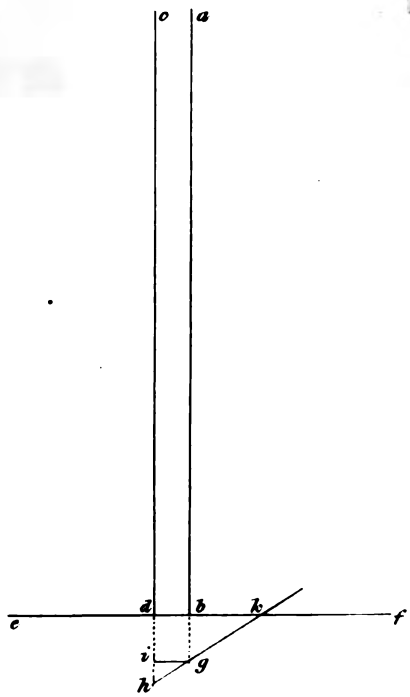

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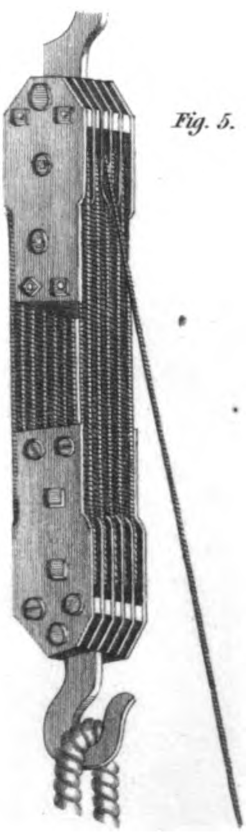

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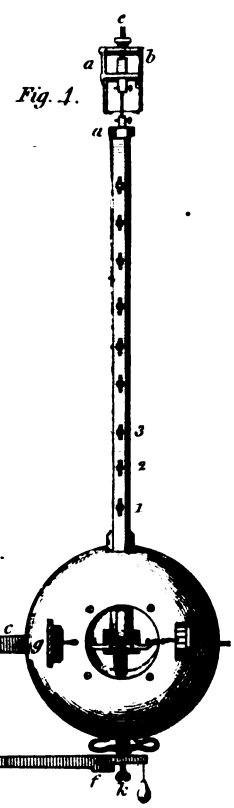

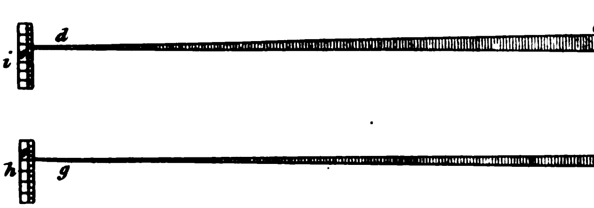

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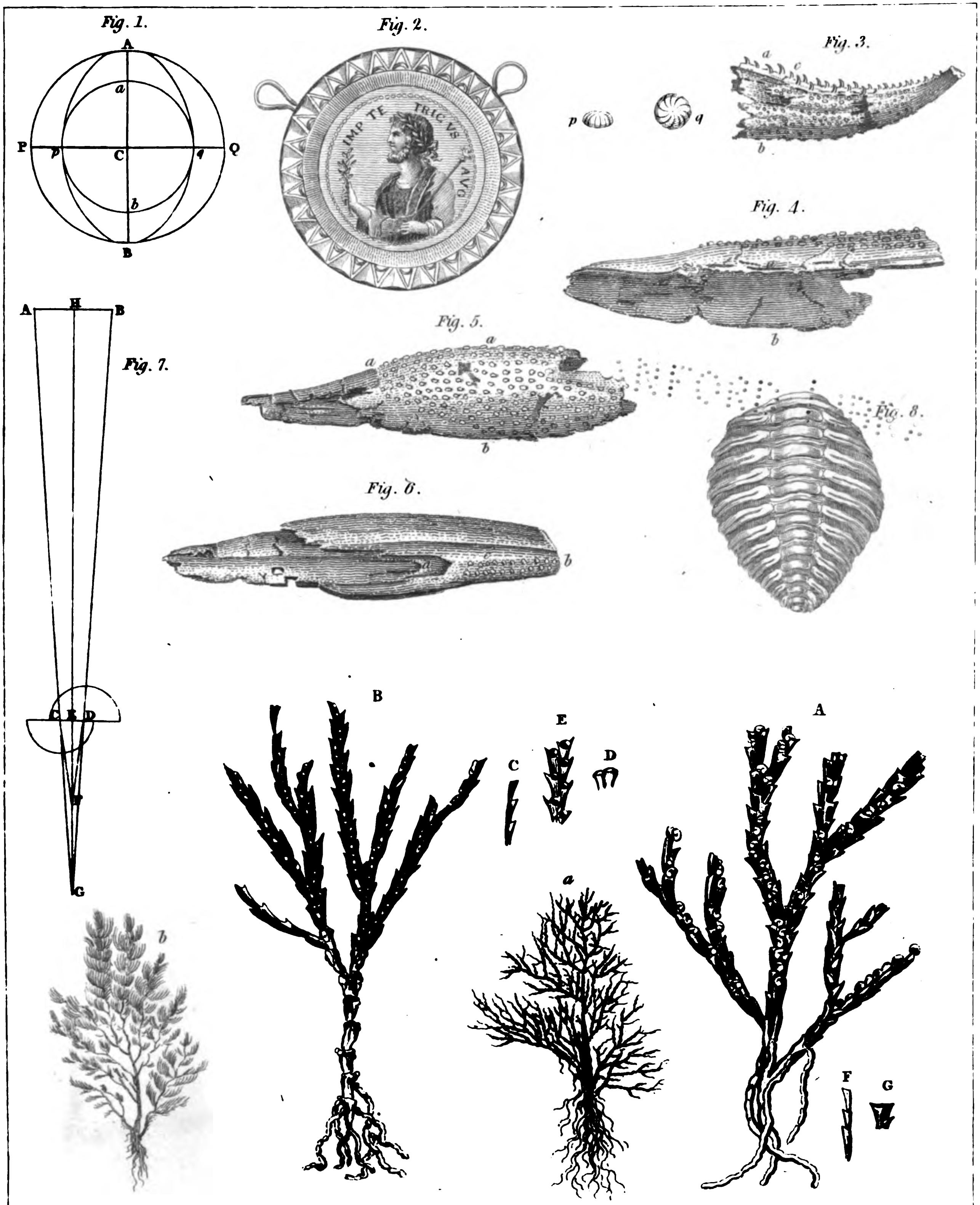
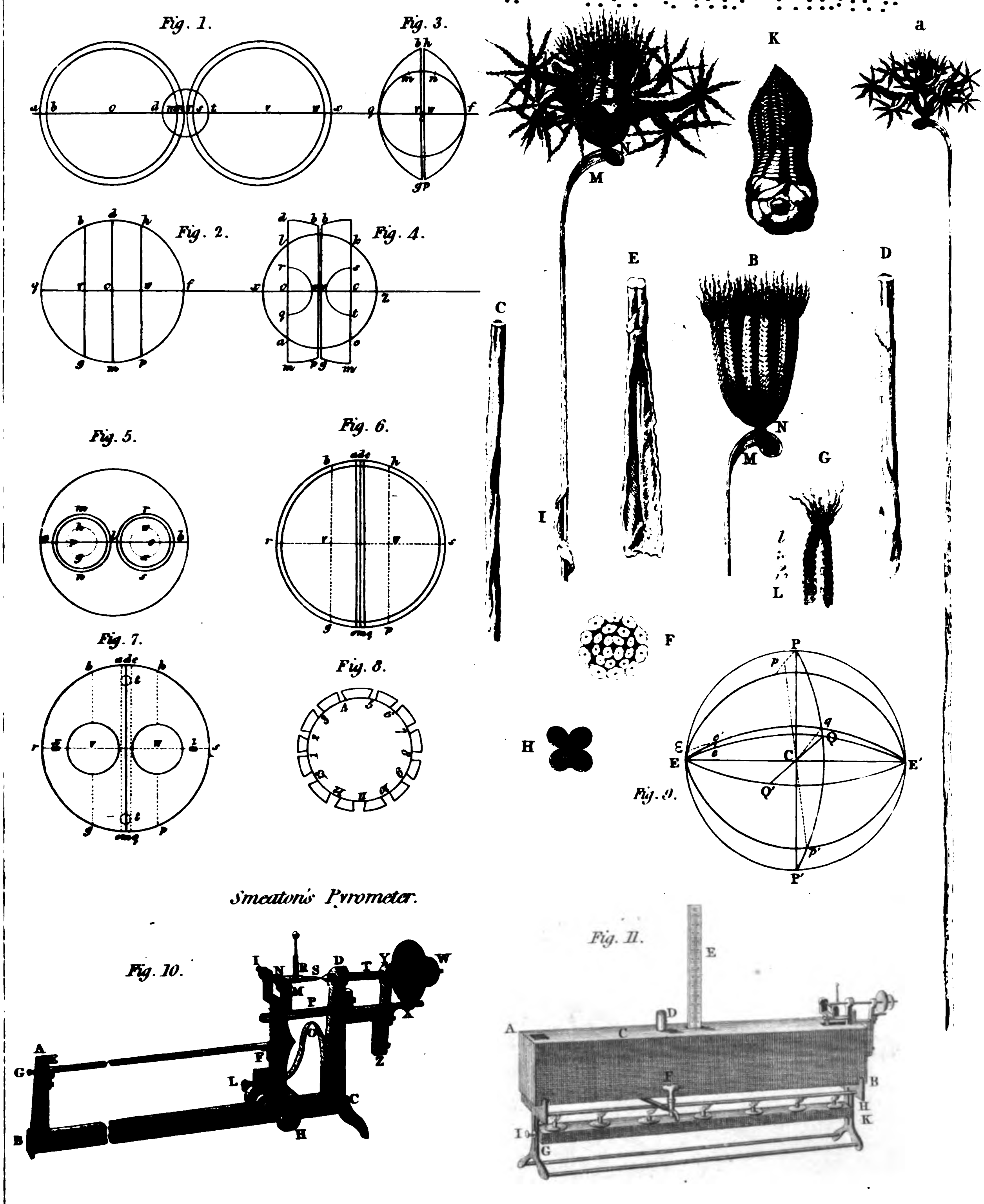


b. The upright featherd Coralline. B. a branch magnified with its tubuli. C. The upright section of the cells shewing the Eggs. D. The cross section.

a. The Snail bearing Coralline. A. a branch magnified. E. The Eggs turn'd to testaceous animals F. The upright section. G. The cross section.



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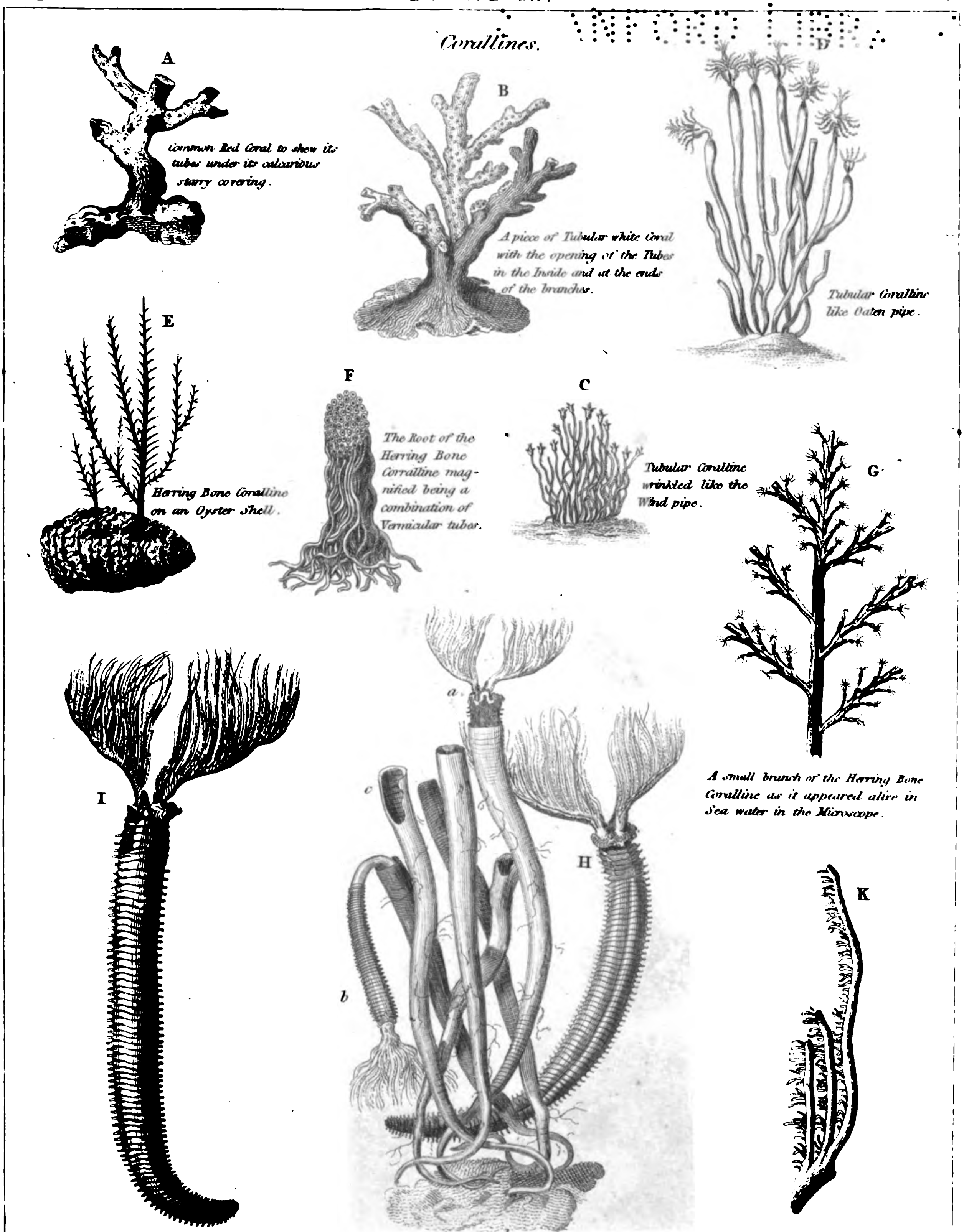
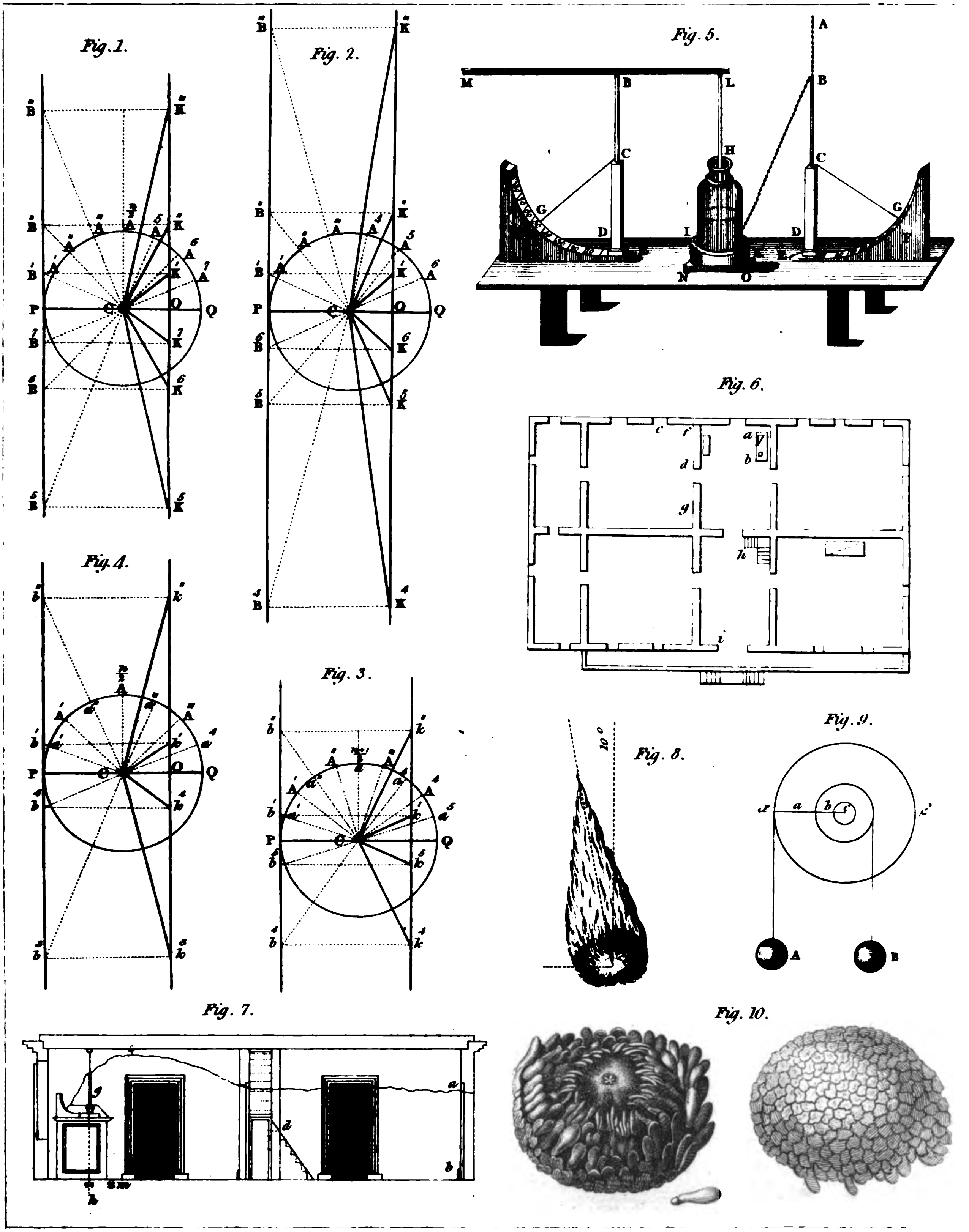


Great Tubular Coralline from Malta with its Scolopendras.



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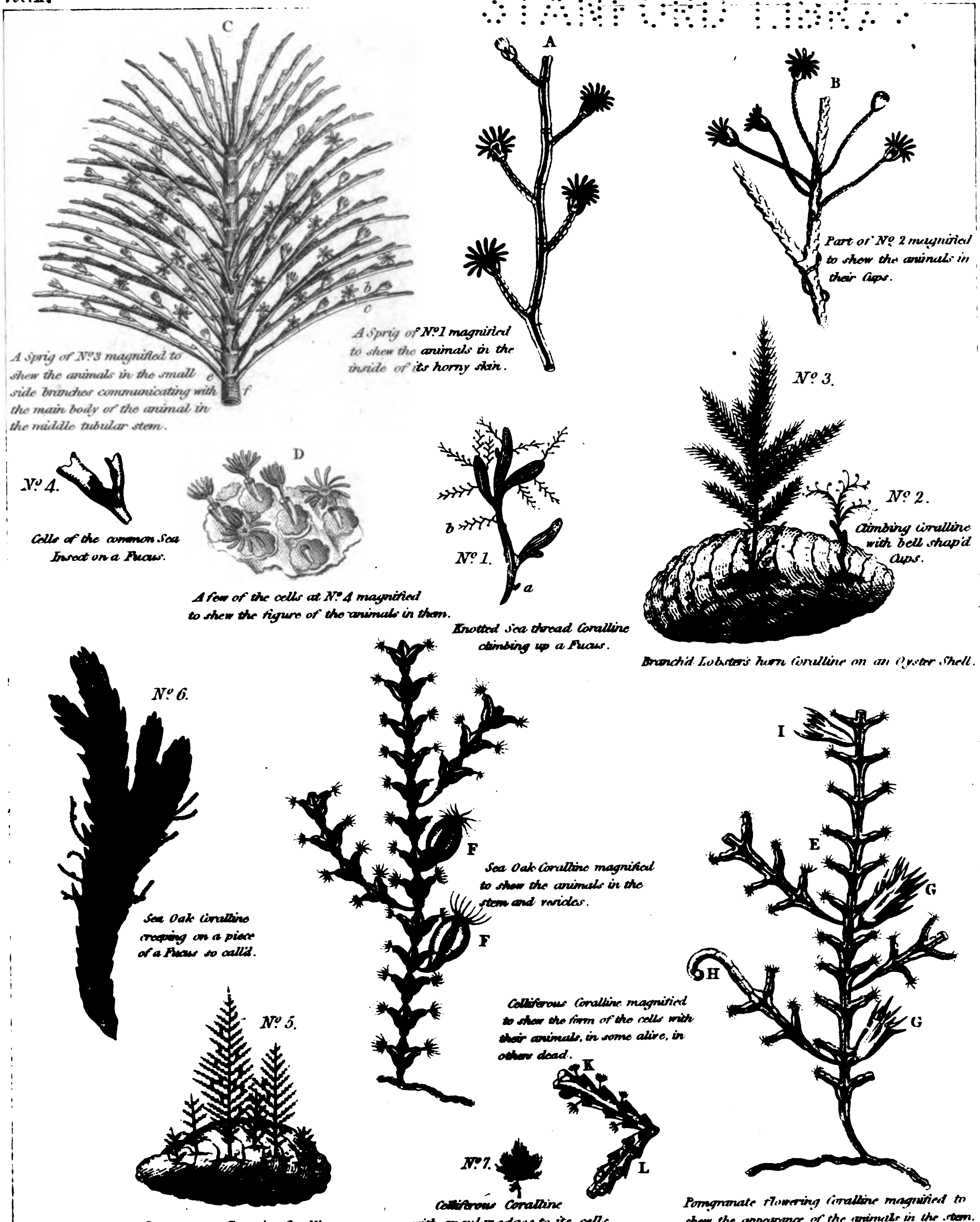

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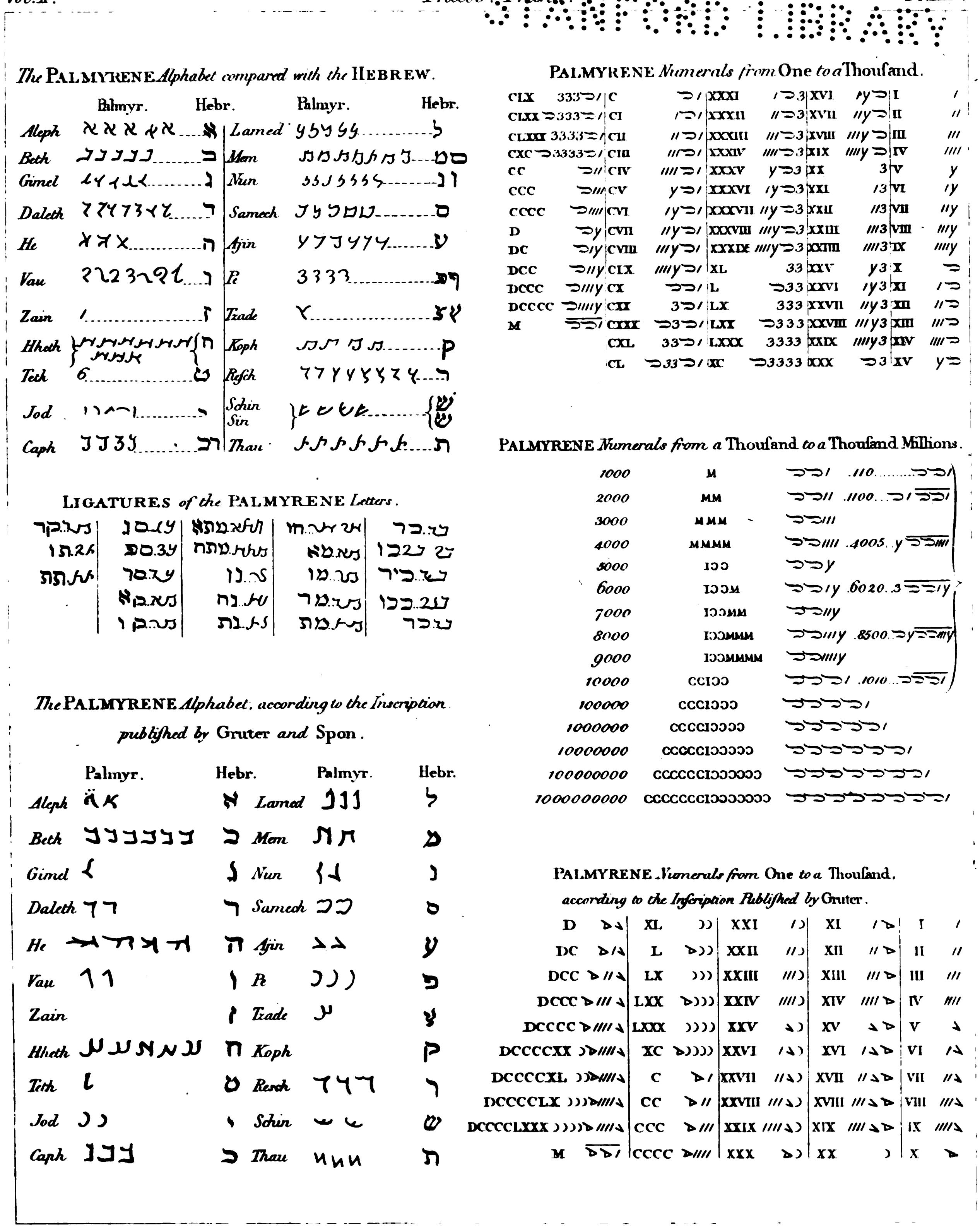

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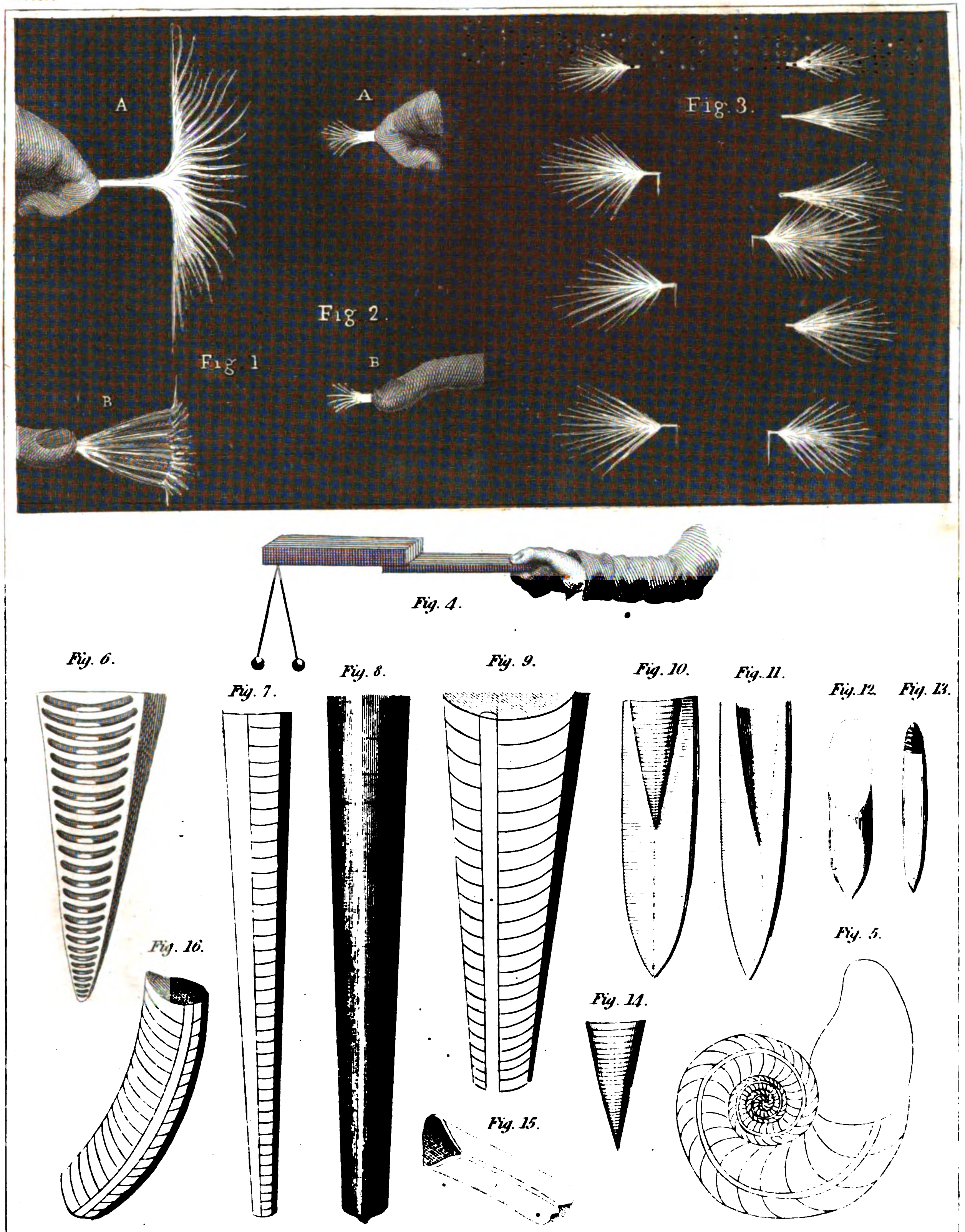

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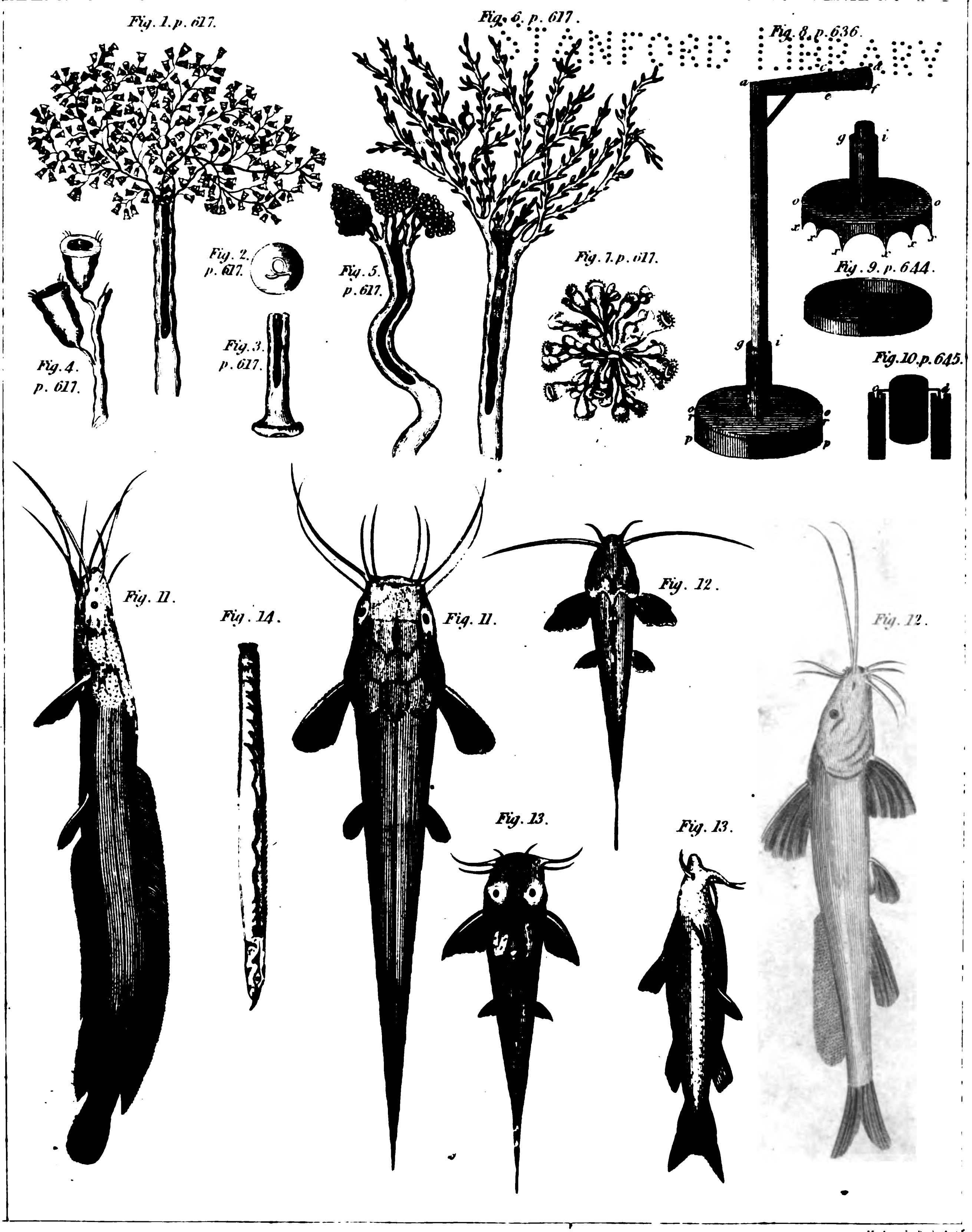

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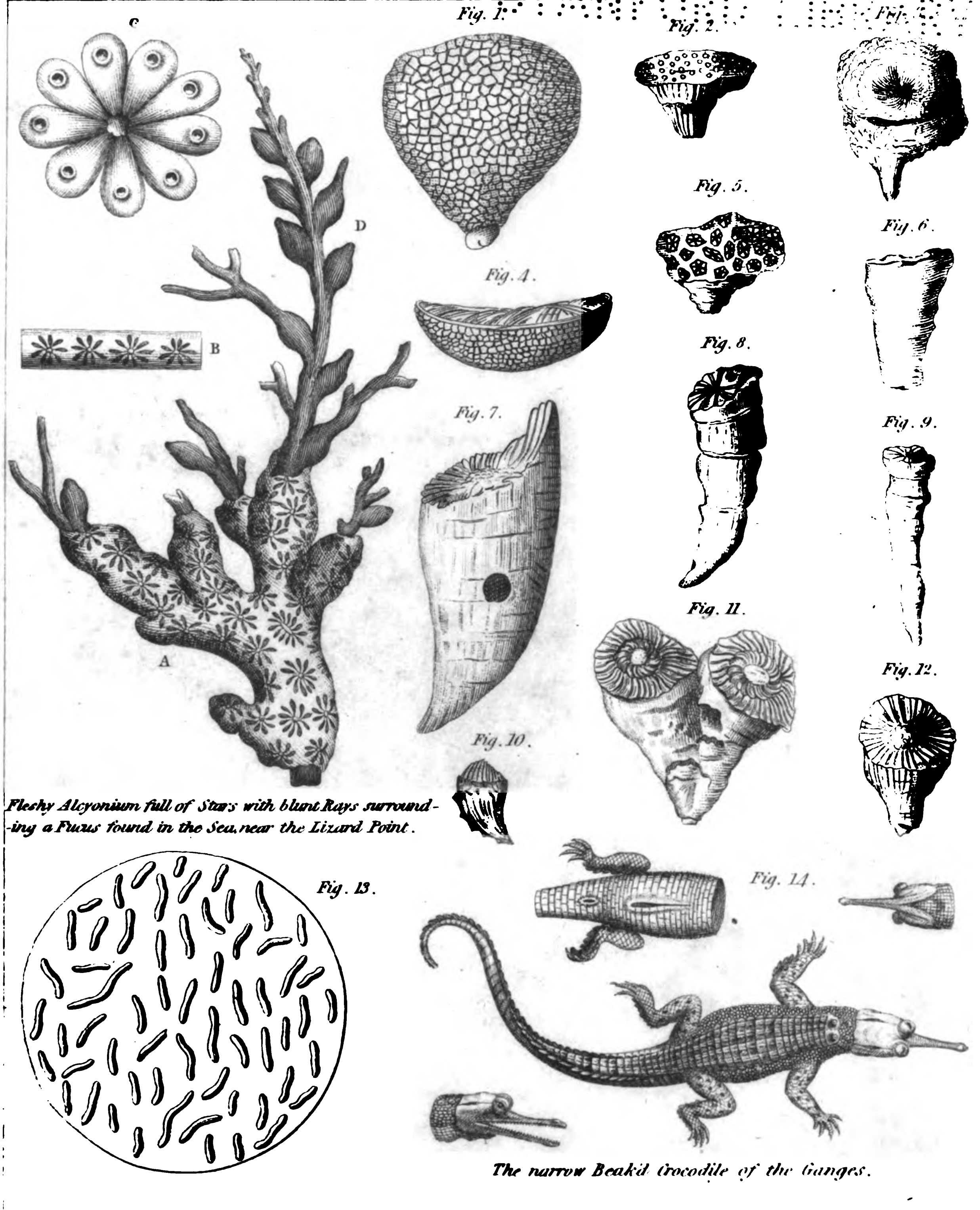

Fleshy Alcyonium full of Stars with blunt Rays surrounding a Fucus found in the Sea, near the Lizard Point.

The narrow Beak'd Crocodile of the Ganges.

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